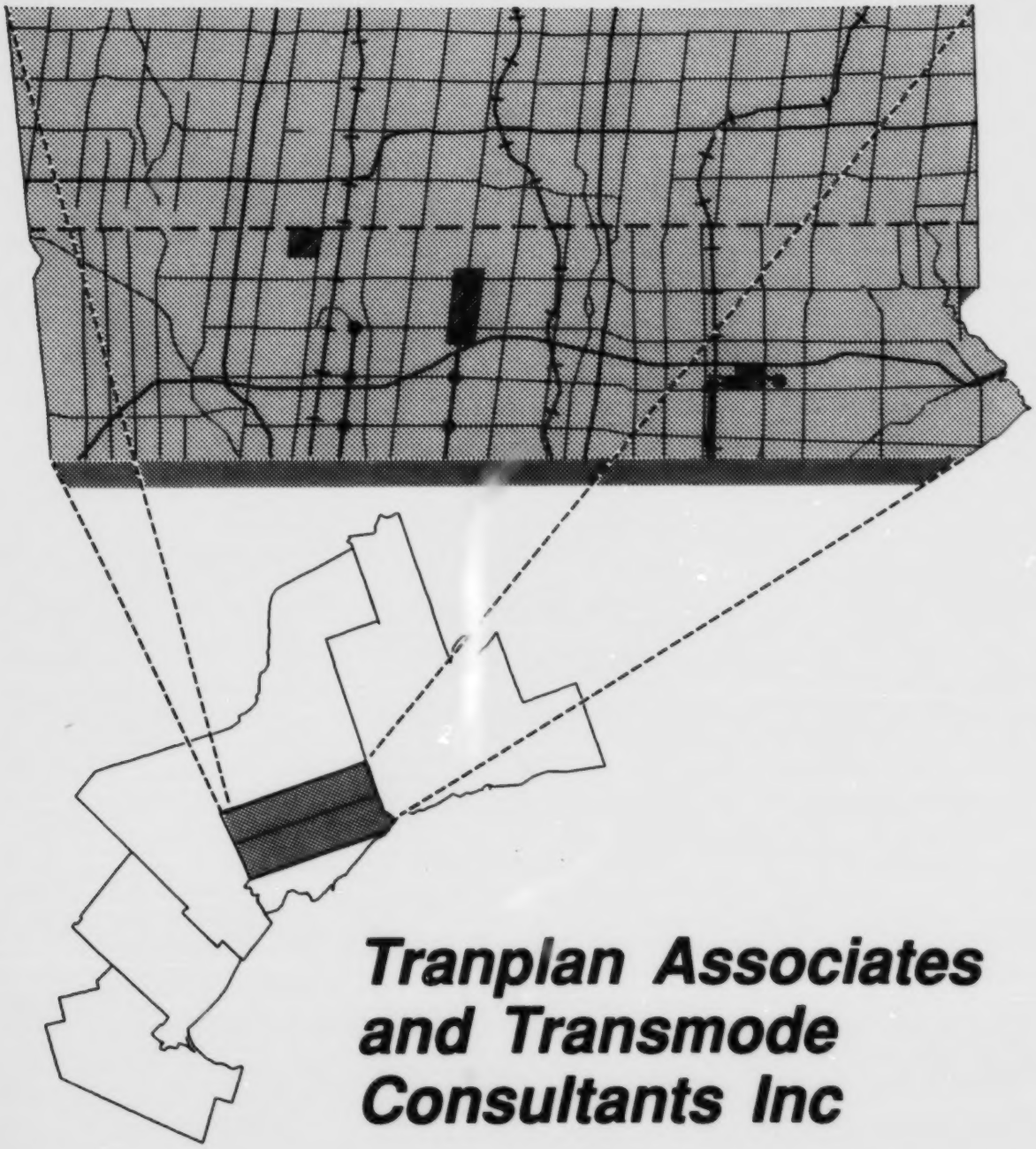
North Metro Boundary Transportation Review



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December 1989

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15 December 1989

Mr. David Duncan
Municipal Transportation Policy Office
Ministry of Transportation
Downsview, Ontario

Dear Mr. Duncan,

We are pleased to submit our final report on the *North Metro Boundary Transportation Review*.

The general scope of this study includes the area of Metro Toronto north of Highway 401 and the rapidly growing urbanized areas of southern York Region. Within this study area, significant improvements in public transportation are required if orderly growth and development is to be achieved and adequate quality of service is to be provided to the public.

In our study, we have adopted a broad perspective, one that is sensitive to cross boundary travel needs as well as travel needs within northern Metro, and one that is responsive to the land use principles embodied in Metropolitan Toronto's Official Plan. Considerable emphasis has been placed on developing solutions that are both cost effective and affordable and which take advantage of opportunities for more intensive and efficient use of existing transportation facilities and services within the study area.

In the formulation of alternative solutions, we have also taken into account commitments such as the recent decision to extend the Spadina Subway as well as a number of other proposals such as those included in *Network 2011*, *Transportation Directions for the Greater Toronto Area*, and the recently completed *York Region Transit Study*.

Our findings as to the most appropriate transportation solutions that should be adopted involve three major categories of transit improvements.

First, we conclude that the most effective means of accommodating cross boundary travel between the rapidly growing residential areas of York Region and increased employment opportunities in downtown Toronto is to significantly expand frequency of service on the Bradford, Richmond Hill and Stouffville GO commuter rail routes, to extend the Richmond Hill service to a new terminal near Bloomington Road, and to construct a new stations on the Stouffville route that will provide access to the Bloor-Danforth Subway and the Scarborough RT.

Second, we consider a number of transit priority schemes on major arterial roads to be essential. These include reserved bus lanes on north-south arterials such as Dufferin Street, Yonge Street, and McGowan Avenue as well as Sheppard Avenue east of Yonge Street. Reserved transit lanes may also be necessary on Steeles and Finch Avenues, east of Yonge Street.

Finally, in our view, a northerly extension of the Spadina Subway, subsequently turning east to join the Yonge Subway, in combination with a major east-west busway within the Finch Hydro corridor, supports Metro Toronto's Official Plan (including development of the North York City Centre) in a more cost effective manner than the proposed Sheppard Subway.

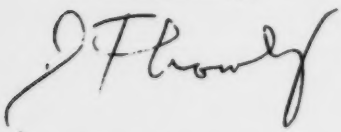
The subway loop concept increases cross boundary transit travel by about 10% compared to the Base Case whereas the Sheppard Subway proposal would increase cross boundary transit travel by less than 5%. The loop proposal also provides significant operational advantages for the TTC in terms of a 10% increase in Yonge Subway capacity and better utilization of the Spadina Subway. Possible variations of the subway loop concept, including the Hydro corridor busway, within the general area bounded by Finch and Steeles Avenues, may warrant further consideration from the standpoint of incremental benefits and community impacts and are also described in our report.

At a total capital cost above the base case of $481 million, compared to the $1822 million investment required for the Sheppard Subway, this solution provides substantial capital savings that can be used for other needed transit improvements elsewhere in Metro and in the Greater Toronto Area.

During the course of this study, we relied heavily on data and information provided by staff of your office, the Metropolitan Toronto Planning Department, the Toronto Transit Commission, the York Region Engineering Department, and the Data Management Group of the University of Toronto Joint Program in Transportation, all of whom were most cooperative and whose assistance is greatly appreciated. We are particularly indebted to staff of the Service Planning Department of the TTC who carried out major, time consuming computer analyses on our behalf and to Hatch Associates for their assistance in estimating subway costs.

Naturally, of course, we assume full responsibility for the interpretation of all data and results as well as for the final conclusions of the study.

Yours sincerely,



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North Metro Boundary Transportation Review

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Municipal Transportation Planning Office
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by

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December, 1989

ERRATA

Page 8 — The authors of this report apologize for inadvertently failing to acknowledge GO Transit's participation in the study Review Committee.

Summary

As in any large urban area experiencing rapid population growth, a wide variety of transportation issues within the Greater Toronto Area (GTA) are at the forefront of political and public debate. This study is concerned with one segment of overall GTA transportation issues, namely, priorities for transit improvement within north Metro including cross boundary transit between Metro Toronto and the Region of York. The study is confined to the area bounded by Highway 401 and the northern limit of urbanized development in the Region of York.

Although the entire GTA has been experiencing rapid increases in population and employment, differential growth rates between Metropolitan Toronto and the surrounding regional municipalities have resulted in a large increase in cross boundary travel. These travel patterns do not necessarily conform to the jurisdictional responsibilities for planning and operation of the area's transportation system. Moreover, the increase in transportation needs within the GTA has resulted in greater competition between various agencies and governments for the limited funding available. For these reasons, the principal objective of the study has been to develop proposals for transit improvements that are cost effective, that are comprehensive in terms of dealing with travel needs within the study area independently of jurisdictional boundaries, and that are also supportive of long term objectives for land use development.

The basic approach of the study builds on existing information and data in a process designed to:

identify major transit needs and opportunities for increased modal split,

develop realistic responses, building upon proposals that have already been suggested such as those included in *Network 2011* and other studies, and,

evaluate these alternatives in terms of cost effectiveness and compatibility with local and regional planning objectives, particularly those implicit in Metro's official plan.

In this regard, the identification of future transit needs is fundamental to the development of alternative transit improvements. While this subject is treated extensively in Section 2 of the report, a few key characteristics of travel demand should be noted.

First, data from the 1986 *Transportation Tomorrow Survey* show that on an average weekday, about 79,000 York Region residents commuted to Metropolitan Toronto (65,000 to work and 14,000 to school). In addition, about 53,000 Metro residents commuted to jobs within the Region of York. Compared to 1977, these figures reflect almost a doubling of trips across the north Metro boundary over the previous ten years; a further doubling might reasonably be expected again before 2011.

Second, although transit plays an important role in attracting about 50% of all cross boundary peak period trips from York Region to the central area of Metro (compared to 64% for all work trips from within Metro), transit use for trips from York Region to other Metro destinations is much lower. As a result, existing cross boundary travel already creates considerable congestion on north-south arterials. Even with planned improvements in road capacity, congestion will continue to increase with the growth in cross boundary work trips. By far, the largest deficiencies in road capacity will occur in the central section of the Metro boundary at Steeles Avenue, although the uneven distribution of traffic will also result in serious deficiencies elsewhere.

Third, in addition to increased travel from York Region to the traditional central business district in downtown Toronto, projections indicate a significant increase in cross boundary travel from York Region to a variety of other Metro locations, as well. For example, a large increase in travel is projected between central York Region and Planning District 11, which includes the North York City Centre, one of the key focal points for development embodied in the decentralization principles of the Metropolitan Toronto Official Plan. In fact, the projected increase in travel from central York Region to this district is larger than for any other origin district within the entire GTA (including other planning districts within Metro).

Finally, these projections of future travel demand across the north Metro boundary suggest much greater reliance on public transit will be necessary, if increases in cross boundary

travel are to accommodated, and that significant improvements in public transportation will be required in order to avoid further deterioration in the quality of transit service on such already overcrowded facilities as the Yonge Street subway. Overall, by 2011, it is estimated that some 21,000 cross boundary trips could be attracted to transit during the peak hour, depending upon the nature and extent of transit improvements.

In summary, the travel demand analysis suggests that anticipated growth in population and employment and its distribution throughout the GTA, will result in a large increase in travel demand, primarily related to work trips, across the boundary between Metropolitan Toronto and the Region of York, in both directions. The largest component of this cross boundary travel will occur between the central section of York Region and the entire Yonge Street corridor within Metropolitan Toronto, including the North York City Centre, other major development nodes at subway stations, and downtown locations. In addition to growth in downtown oriented work trips from other areas of York (primarily from Central York and Markham), significant growth in work trips is also expected between the eastern portion of south York (Markham) and northeast Metro (including the Scarborough City Centre) and, to the west, between Vaughan and northwest Metro. A substantial increase in reverse flow, cross boundary work trips is also expected from Metro to York.

A number of underlying principles formed the basis for developing transit responses to these anticipated needs. First, for the downtown oriented work trips, increases in modal split can best be achieved through expansion of service on all three GO Transit commuter rail routes. Such expansion would also provide some relief for existing surface transit services, as well as the Yonge Subway, which now handles most of this downtown oriented traffic, particularly from central York.

Second, for the balance of the cross boundary travel demand, expansion of the rapid transit system within Metropolitan Toronto, more extensive use of higher order surface transit such as exclusive transit and high occupancy vehicle (HOV) lanes, and improvements in the integration of cross boundary and intra-regional services (both in York and Metropolitan Toronto), all represent important opportunities for increased modal split.

Third, realistic responses to cross boundary transit issues must be sensitive to, and adequately reflect, transit needs of Metropolitan Toronto, including those related to land use objectives embodied in the Metro Official Plan. In other words, major transit improvements should accommodate goals related both to cross boundary needs as well as to priorities already identified by Metropolitan Toronto. The latter include increased transit accessibility for major sub-centres in North York and Scarborough and some form of crosstown rapid transit that inter-connects with the existing network of radial, commuter rail and subway facilities.

Using these principles as guidelines, four distinct transit alternatives were developed in response to anticipated travel needs, in consultation with a Review Committee composed of senior representatives of the Metropolitan Toronto Planning Department, the Toronto Transit Commission, the York Region Engineering Department, and the Ministry of Transportation. Although these alternatives are described in greater detail in the body of the report, some of their key features can be described as follows.

The *Base Case* alternative stresses improvements in commuter rail services as the primary means of accommodating cross boundary travel destined to downtown Toronto. These commuter rail improvements include increases in train frequency, new stations, and an extension of the Richmond Hill service to a new terminal at Bloomington Road. The Base Case also includes reserved transit lanes on certain north-south arterial roads, as well as Sheppard Avenue. In addition, regional transit gateways are emphasized. However, aside from the already committed extension of the Spadina subway between Wilson Avenue and Sheppard Avenue, no other rapid transit improvements are included. The Base Case essentially represents the minimum improvements that will be required by 2011.

The remaining three alternatives each involve the addition of new rapid transit facilities over and above these Base Case improvements. The *Sheppard Emphasis* alternative, for example, is essentially the Base Case supplemented by the addition of the Sheppard Avenue subway between the Spadina Subway extension and the Scarborough City Centre. In this case, reserved transit lanes along Sheppard Avenue (which are included in the Base Case) become redundant. This alternative is consistent with priorities already established by the

Council of Metropolitan Toronto with respect to development support for the North York and Scarborough City Centres and the need for an east-west crosstown rapid transit facility.

In the *Finch Loop* alternative, the Spadina subway is first extended north of Sheppard Avenue to the general vicinity of the Finch Hydro Corridor and, subsequently, east to join the Finch terminal of the Yonge Street subway, thereby closing the "loop" between the Spadina subway and the Yonge subway. This subway extension is supplemented by an east-west busway involving reserved bus lanes within the Finch Hydro Corridor to the west, from Dufferin Street, and to the east, from Yonge Street. The Finch Loop alternative was developed as a lower cost response for supporting development of the North York City Centre development and providing crosstown rapid transit. It was also motivated by operational opportunities for increasing capacity of the Yonge Subway (by eliminating turnaround delays at the Finch and Sheppard terminals which now control maximum possible train frequency) and achieving better balance of passenger volumes between the Spadina and Yonge subways.

In the fourth, or *Radial Network* alternative, the Yonge Subway is extended north of the Metro boundary to Langstaff, and the Spadina Subway is extended to the Metro boundary in the general vicinity of York University. In this alternative, the east-west busway is retained as a *continuous* facility between McCowan Road in the east and a location just to the west of Highway 400. The Yonge Subway component of this alternative would improve transit accessibility to the North York City Centre from its largest work trip growth market.

These four alternatives were subsequently evaluated in terms of relative costs, travel impacts, TTC operational benefits, and compatibility with land use objectives. Cost estimates for the Base Case improvements were not included in this study. However, the Base Case was used as the point of reference and comparative measures were estimated in relation to the Base Case.

In fact, the Base Case improvements are expected to attract a substantial proportion of the total cross boundary transit potential (17,000 out of the 21,000 potential peak hour trips forecast for 2011) leaving a residual of some 4,000 trips that could be attracted to transit

as a result of additional transit improvements. From the standpoint of cross boundary travel alone, therefore, potential benefits of further rapid transit expansion beyond the Base Case are relatively modest.

The Base Case, however, provides few advantages with respect to congestion and level of service on the existing subway system or on east-west arterials within Metro. Although proposed expansion of the Stouffville commuter rail service, including new stations, does support development of the Scarborough City Centre, the Base Case provides limited support for development of the North York City Centre.

This basic alternative also raises questions as to the rationale for the already approved Spadina Subway extension to Sheppard Avenue, inasmuch as travel impacts for this large capital investment will be negligible without some additional expansion of the rapid transit network.

For the remaining alternatives, the comparative evaluation is summarized in Exhibit 4.7 of the report (reproduced on the following page). Of the three alternatives for expansion of the Base Case, the Finch Loop option, shown in Exhibit 3.5 (reproduced at the end of this summary) is the most cost effective from the standpoint of the impacts considered. At an estimated capital investment of $481 million above the Base Case, for both the subway and busway components of this alternative, this option represents a saving of $1,341 million with respect to the Sheppard Emphasis, and $409 million with respect to the Radial Network options (considering only the investment costs).

The Finch Loop increases cross boundary transit use by about 10% compared to the Base Case, permits a 10% increase in the capacity of the Yonge Subway, has significant operational benefits with respect to redistributing traffic to the Spadina Subway, and improves opportunities for increasing integration of cross boundary transit services with the TTC network. The crosstown busway component associated with the Finch Loop option should also reduce congestion on east-west arterials and improve the level of service for transit users within Metro.

Summary Evaluation Relative to the Base Case

Item	Loop	Radial	Sheppard
INCREMENTAL INVESTMENT ($Millions)			
Relative to:			
Base Case	481	890	1,822
Finch Loop		409	1,341
Radial Network			932
2011 INCREMENTAL ANNUAL COST @ 10% ($Millions)			
Relative to:			
Base Case	45	111	189
Finch Loop		66	144
Radial Network			78
Cross Boundary			
Incremental Peak Volume	2,000	2,100	600
Yonge Subway Peak Hour			
Increased Capacity	3,000	3,000	
Diversions to Spadina	2,000		
Land Use Benefits			
North York	High	High	High
Scarborough	Low	Low	High
Langstaff Gateway	Low	High	Low
Other			
Sheppard Corridor	Low	Low	High
McLean Hunter	Medium	High	High
Finch and Yonge	High	High	Medium
Tank Farms	Medium	High	Low
York University	High	High	Low

Recognizing the continuum of development represented by three distinct subway stations now serving the North York City Centre, the Finch Loop option should be as supportive of development of this centre as the Sheppard Emphasis option, but slightly less supportive than the Radial Network option. It is also supportive of new development potential at Yonge and Highway 401 (McLean Hunter site), Finch and Keele, and York University.

Although the Finch Loop option provides little or no support for the Scarborough City Centre or other development potential within the Sheppard Avenue corridor, over and above the Base Case, given the magnitude of capital cost savings relative to the Sheppard Emphasis, there are other transit alternatives which better support the Scarborough Centre which can be considered, such as extension of the existing RT.

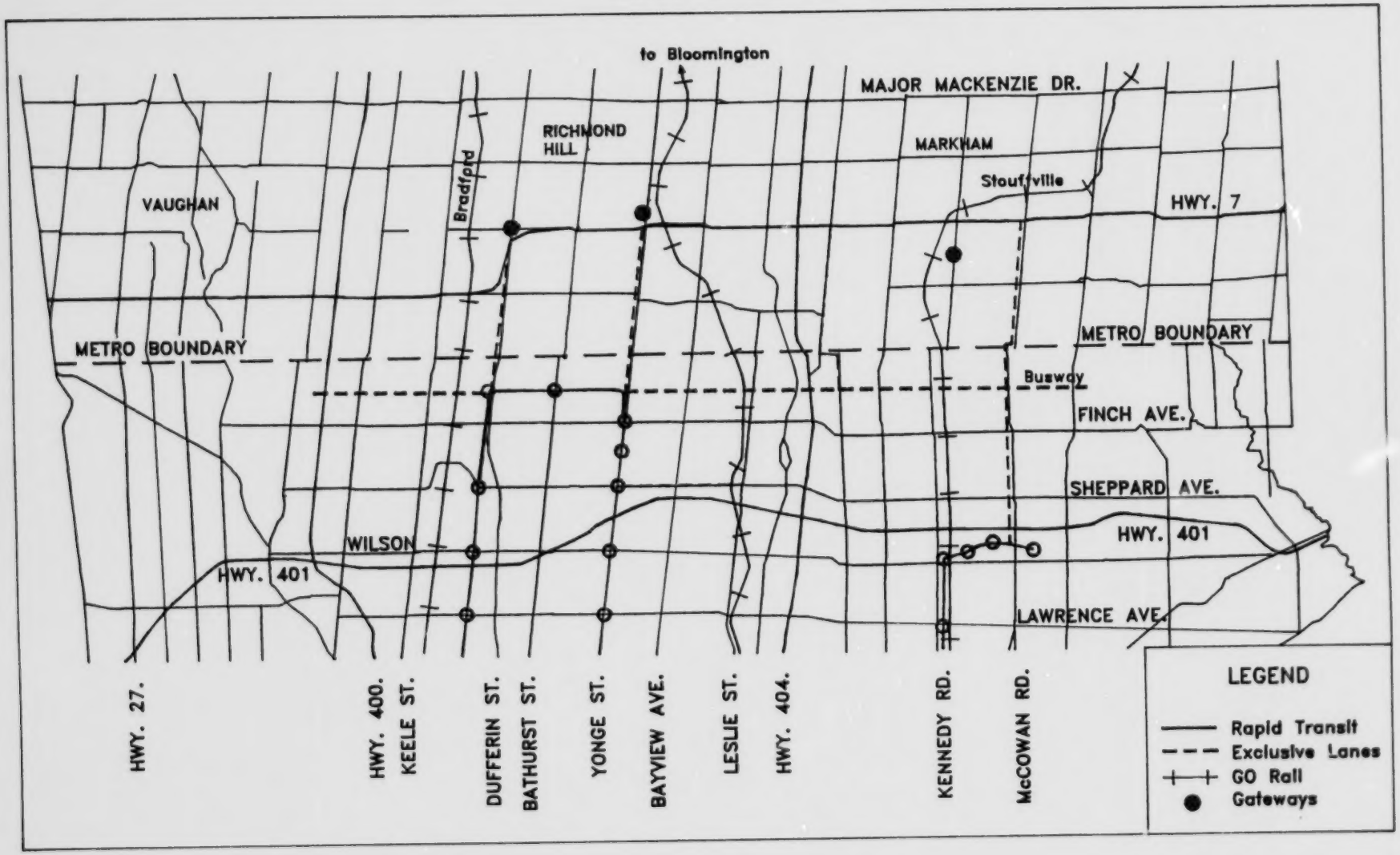
The conclusions of this study favour the Finch Loop *among the four options considered.* However, other variations in transit system development, that may have potential for equivalent or better cost effectiveness, are suggested by the analysis. These may justify further consideration in the event of serious community opposition to some segments of the Hydro corridor busway.

Among these, a *modified* Radial Network, involving extension of the Yonge Subway to Steeles Avenue and extension of the Spadina Subway directly along Dufferin Street to the Metro boundary, in combination with reserved bus lanes on Steeles and Finch Avenues, should produce impacts comparable to those of the Finch Loop option at a similar total capital cost. A more costly variation involves completing the Yonge-Spadina loop along Steeles Avenue. Under either of these variations, railheads to the Yonge-University-Spadina subway system at the Metro boundary introduce greater flexibility with respect to route structure and the choice of transit technology within York Region. Both variations also provide better support for development of the North York City Centre.

Given the range of possibilities, the principal recommendation of this study is that, as an interim step in making long awaited decisions on future expansion of the TTC subway system within north Metro, a further commitment to extending the Spadina Subway, at least as far north as the Finch Hydro corridor, would be an appropriate action at this time as the first stage of completing the Finch Loop or some modification thereof. Clearly, the

scheduling of these improvements should be established within the context of a comprehensive review of other transportation priorities elsewhere within the GTA that have not been considered in this study.

FINCH LOOP


to Bloomington
MAJOR MACKENZIE DR.
RICHMOND HILL
MARKHAM
Bradford
Stouffville
VAUGHAN
HWY. 7
METRO BOUNDARY
METRO BOUNDARY
Busway
FINCH AVE.
SHEPPARD AVE.
WILSON
HWY. 401
HWY. 401
LAWRENCE AVE.
HWY. 27.
HWY. 400.
KEELE ST.
DUFFERIN ST.
BATHURST ST.
YONGE ST.
BAYVIEW AVE.
LESLIE ST.
HWY. 404.
KENNEDY RD.
McCOWAN RD.
LEGEND
Rapid Transit
Exclusive Lanes
GO Rail
Gateways

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North Boundary Transportation Study

1. Introduction

1.1 Purpose and Scope of the Study

As in any large urban area experiencing rapid population growth, a wide variety of transportation issues within the Greater Toronto Area (GTA) are at the forefront of political and public debate. In general terms, these issues relate to congestion on heavily used roads and transit services, perceived inequities in the quality and level of transit service available in different sub-areas of the region, accessibility for the handicapped, land use impacts, environmental and community concerns, and methods of finance. This particular study is concerned with one segment of overall GTA transportation issues, namely, priorities for transit improvement within north Metro including cross boundary transit between Metro Toronto and the Region of York.

Transportation needs and priorities within north Metro and the Region of York can be viewed from a variety of perspectives ranging from local transit access to broader inter-regional transportation issues. In addition, there is a variety of existing agreements and proposals for improved transit which need to be rationalized within a comprehensive strategy that is sensitive to the aims and objectives of the different levels of government involved in transportation planning for the GTA. User concerns, subsidy policies, operational issues, and official land use objectives are all matters that must be taken into consideration. Within this context, the primary purpose of the present study is to develop a plan for improvements in public transportation that will meet future needs in a cost effective manner and which are likely to achieve a reasonable degree of consensus among the various governments responsible for orderly growth and development of the study area.

Although there is a high degree of interaction between road and transit improvements, the scope of the study is primarily restricted to consideration of public transit and, as such, does not deal directly with the question of road needs. Anticipated improvements to the road network, of course, are taken into account inasmuch as they affect future transit demand and opportunities for improvements in transit. In terms of geographic scope, the

study is confined to the area bounded by Highway 401 in the south and the northern limits of urbanized development in the Region of York between Peel and Durham. The relevant time frame for purposes of this study is 2011.

1.2 Background

A number of specific problems which are peculiar to Metropolitan Toronto and the adjacent Regional Municipality of York, provide the impetus for this study. First, travel patterns within the GTA do not necessarily conform to the jurisdictional responsibilities for both planning and operation of the area's transportation system. Regional governments such as Metro and York, operating organizations such as the TTC and other municipal transit operators, and the provincial government often view transportation needs and priorities from different perspectives. As a result, decisions made by one agency may not be consistent with those of another agency serving a different constituency within the same region. Within the GTA, therefore, one of the key problems is to develop consensus among the various parties involved as to a comprehensive transportation strategy that is sensitive both to user needs and the objectives of individual governments for growth and development.

Second, although the entire GTA has been experiencing rapid increases in population and employment, differential growth rates between Metropolitan Toronto and the surrounding regional municipalities have resulted in a large increase in cross boundary travel that cannot always be adequately accommodated by existing institutions and organizations. For example, as shown in Exhibits 1.1 and 1.2, while predicted increases in population and employment growth *rates* are much smaller for Metro Toronto than for the adjacent regional municipalities, in absolute terms, the largest increases in *population* are expected to occur outside Metro Toronto while very large increases in employment are expected to continue within Metro. As a result, for these forecasts, a significant increase in cross boundary travel is expected as more of the new job opportunities within Metro are filled by non-Metro residents.[1] This potential for additional cross boundary travel may not be adequately reflected in the planning of transportation improvements within a particular jurisdiction.

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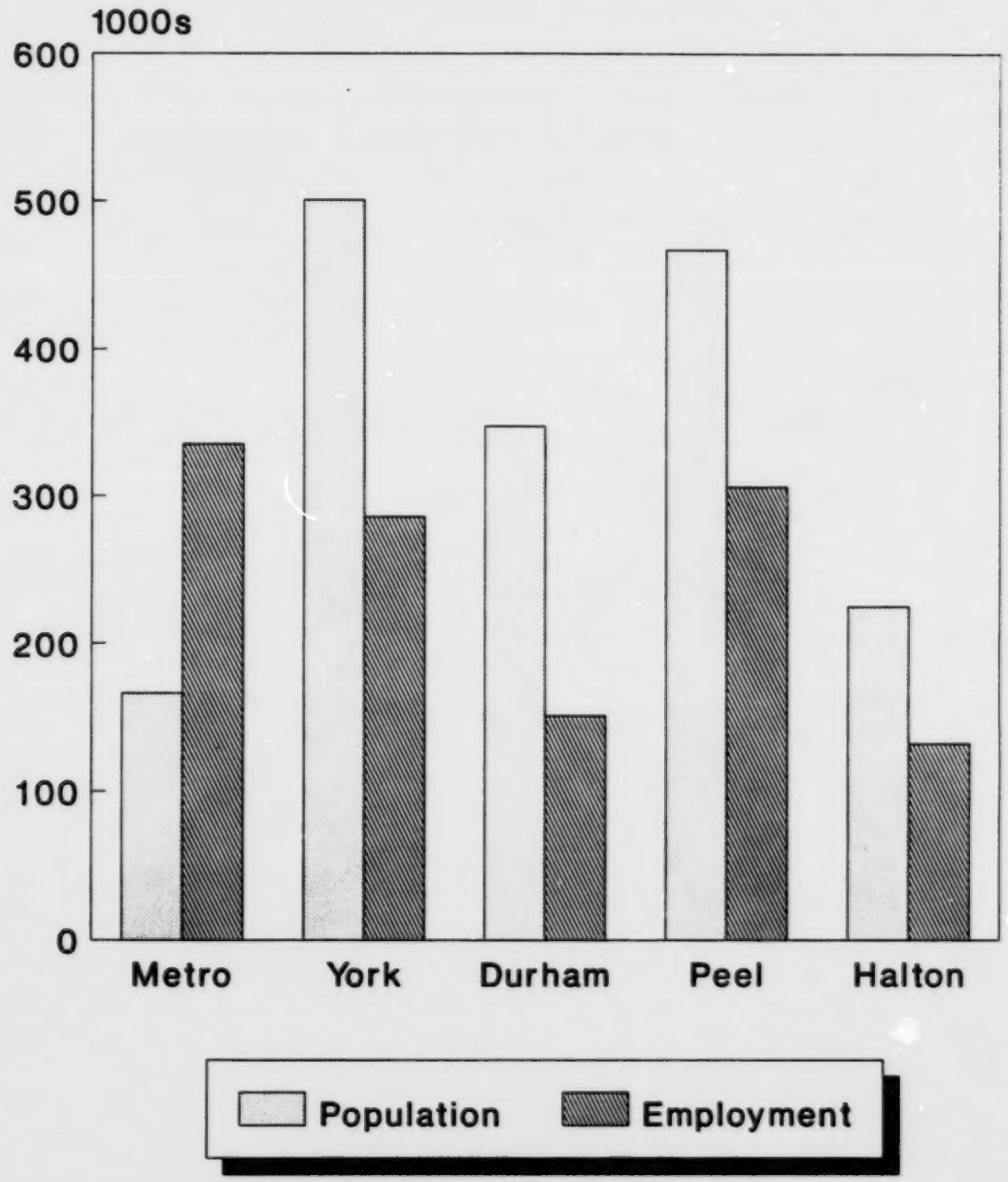
[1] These predictions of population and employment growth are shown only for purposes of illustration. Depending upon the source, they are subject to considerable variation and, in fact, Metropolitan Toronto is now giving serious consideration to increasing Metro's population so as to reduce, among other factors, the need for long distance commuting.

Exhibit 1.1

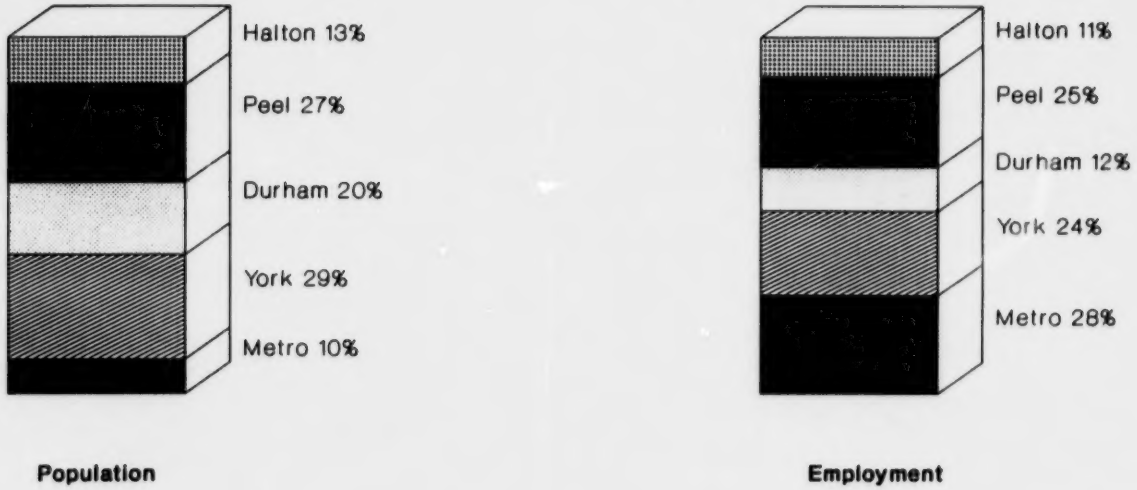
Projected GTA Population and Employment Growth
1986 to 2011



Source: Greater Toronto Coordinating Committee

Exhibit 1.2

Projected GTA Population and Employment Growth Distribution
1986 to 2011



Source: Greater Toronto Coordinating Committee

Third, because cross boundary travel, except in the case of certain GO Transit rail and bus services, usually requires a transfer between at least two operators, a clear need for improvements in fare integration and service coordination has already been identified as a major transportation issue within the GTA. However, there remain a number of jurisdictional, organizational, and subsidy policy practicalities that have yet to be worked out to the satisfaction of the majority of the agencies involved.

Fourth, aside from the ever increasing demands at all levels of government for a wider range of public services, the expansion of transportation needs within the GTA (for both transit and roads) has created increased competition between various agencies and governments for the limited funding available for transportation. Given needs that are far in excess of available resources, this competition for funding complicates the process of achieving an equitable geographic and modal distribution of available funds.

Finally, in dealing with transportation issues within a multi modal regional context, there is a basic conflict between short term travel needs and longer term objectives for the orderly growth and development of the GTA. For example, expanding the capacity of centrally oriented transportation facilities within Metropolitan Toronto as a means of dealing with existing congestion conflicts with objectives for decentralized development embodied in Metro's Official Plan.

Partly in recognition of these issues, several proposals for new transportation services and facilities have already been developed for the GTA that bear directly on North Metro and the Region of York. These are briefly described in the following paragraphs.

Sheppard Subway

Construction of a subway along the general alignment of Sheppard Avenue between the Yonge Subway and the Scarborough Town Centre was adopted by the Council of Metropolitan Toronto as the first priority for expansion of the current TTC rapid transit network. The Sheppard Subway was selected from among a number of rapid transit alternatives recommended jointly by the Metro Planning Department and the TTC in *Network 2011*. From the standpoint of Metro Toronto, the Sheppard Subway supports land use development concepts for the North York and Scarborough city centres and is also

expected to produce significant savings in operating and maintenance costs associated with surface transit in the same general service area. The Sheppard Subway may also provide travel time savings for residents of eastern York (e.g. Markham) who now use cross boundary bus services to access the North York City Centre and the Yonge subway (via the Finch subway terminal). Due to the high capital costs of the Sheppard Subway, some municipal and regional governments within the GTA have expressed concern that implementation of the Sheppard Subway would divert funds from other needed transit and road improvements which they consider to be of higher priority over a long period of time.

GO Rail Expansion

Commuter rail service presently offered on the Bradford, Richmond Hill, and Stouffville routes is limited to 1, 4, and 1 trains per day, respectively, during the peak period in each direction. Recognizing the untapped potential of these services to attract greater ridership for cross boundary travel destined to and from downtown Toronto, a variety of proposals and announcements have been made with respect to increasing train frequencies, route extensions, and the provision of additional park and ride facilities. Some plans are implicit in the Minister's statement of May 1988 whereas others are recommended in various studies such as the recently completed *York Region Transit Study*. In general, there is very little disagreement among any of the various agencies responsible for transportation planning and operations within the GTA as to the desirability of expanding the GO rail system. Priorities for expansion, however, are a question of available funding and geographic equity.

Spadina Subway

Agreement has recently been reached between the provincial government and Metropolitan Toronto to extend the Spadina subway from its present terminal at Wilson to Sheppard Avenue as the first stage of a continuous subway expansion program. At Sheppard Avenue, a variety of subsequent options are available including extensions to the north and north-west as well as an extension to Yonge Street to tie in with the first phase of the proposed Sheppard subway.

Scarborough RT

Extension of the Scarborough RT from its present terminal at McCowan to a new terminal at Malvern is now receiving attention by both the provincial government and the TTC. By improving the transit accessibility of the Scarborough City Centre, this extension

would support land use objectives of Metro's Official Plan and would also reduce the number of transfers required for some residents of north-east Metro destined to downtown Toronto.

Finch-Hydro Bus Facility

The concept of constructing reserved bus lanes within the Finch-Hydro right-of-way has been considered in a number of planning studies including the most recent *York Region Transit Study*. Such a facility is favoured by the Region of York as a means of providing more rapid bus access to the TTC subway network. Due to its relatively close proximity to Sheppard Avenue, there is some degree of consensus that, at least over the short to intermediate term, potential transit demand within northern Metro would be inadequate to sustain both this facility and the Sheppard subway.

In addition to these current proposals for major new facilities and services, there are a number of proposals for expanding the network of reserved bus lanes on major arterial routes and for the establishment of transit gateways at various locations within the GTA. In combination, these proposals for major new transit facilities, reserved bus lanes, and gateways serve as a useful starting point for further analysis of transit needs within the study area.

1.3 Study Approach

Recognizing large number of previous studies concerned with transportation within the study area, the basic approach involved in this study builds on existing information and data in a three stage process designed to:

a. identify major transit needs and opportunities for increased modal split,

b. develop realistic responses to meeting these needs, building upon proposals that have already been suggested, and,

c. evaluate these alternative responses in terms of cost effectiveness and compatibility with local and regional planning objectives.

In developing the various alternatives for subsequent evaluation, it is important to emphasize a number of points. First, wherever possible, attempts have been made to build on previous

work already embodied in existing proposals. Second, long term objectives for land use development, particularly those implicit in Metro's official plan, play an important role in formulating alternative responses for dealing with existing and anticipated transportation issues.

Finally, although existing institutional constraints such as jurisdictional responsibilities, subsidy policies, and barriers to improved fare integration and service coordination are important considerations that must be addressed, they have not influenced the formulation of transit networks that respond to user needs and land use objectives. In other words, the emphasis in this study focuses on the nature and extent of transit services required more so than questions of what agencies will be responsible for their implementation and operation.

During the course of the study, considerable assistance in the form of data, information, and comment was obtained from a Review Committee comprised of representatives of the Ontario Ministry of Transportation, the Metropolitan Toronto Planning Department, the Toronto Transit Commission, and the York Region Engineering Department. Although the Review Committee met periodically to discuss interim progress reports, neither the committee nor the agencies represented bear any responsibility for this report.

2. Travel Needs and Opportunities

2.1 Travel Market Analysis

In assessing travel needs and opportunities within the North Metro Boundary Study area, both current and future demands for travel between York and Metro were considered.

Data from the Transportation Tomorrow Survey (TTS) describing 1986 origin-destination travel patterns were analyzed to describe current travel market conditions. The 1986 analysis considered work and school demands and current patterns of choice and captive transit ridership (for work travel). The 2001/2011 analysis focused on the growth in home to work travel between York and Metro.

The description of existing travel and transit use patterns within the study area was the first step in defining present and future travel markets, and assessing the potential role that transit can be expected to play in satisfying future cross-boundary travel needs.

Overview - Travel Between York and Metro

The TTS results provide an accurate and up-to-date description of travel by purpose and mode within the study area. The TTS data show that 65,000 York Region residents commuted to jobs in Metro and 53,000 Metro residents travelled to jobs in York Region on the average weekday in 1986. An additional 14,000 York Region students travelled to Metro Toronto universities and colleges on the average weekday. These daily home-based work and school travel account for over 80 per cent of AM peak period/peak direction travel across the north Metro boundary.

AM Peak period travel more than doubled between 1977 and 1987 (from 37,000 to 75,000 person trips), and may double again before 2011, as York Region's population is projected to increase from 350,000, in 1986, to 840,000, by 2011. The travel needs of workers and students travelling across the North Metro Boundary will have to be better served in the future, if a higher proportion of the growth in peak period demand is to be accommodated by transit.

York Region residents presently work and study in Metropolitan Toronto's Central Area and suburbs, while Metro residents work mostly in south York Region (Vaughan, Richmond Hill and Markham), as discussed in the following paragraphs.

Exhibit 2.1 illustrates the volume of home to work travel from York Region to the Central Area of Toronto and other parts of Metro, as of 1986, and the transit market shares (mode splits) from York to Metro districts. Mode splits to Metro districts from within Metro are also shown to indicate differences in transit market penetration for work trips originating in York and Metro.

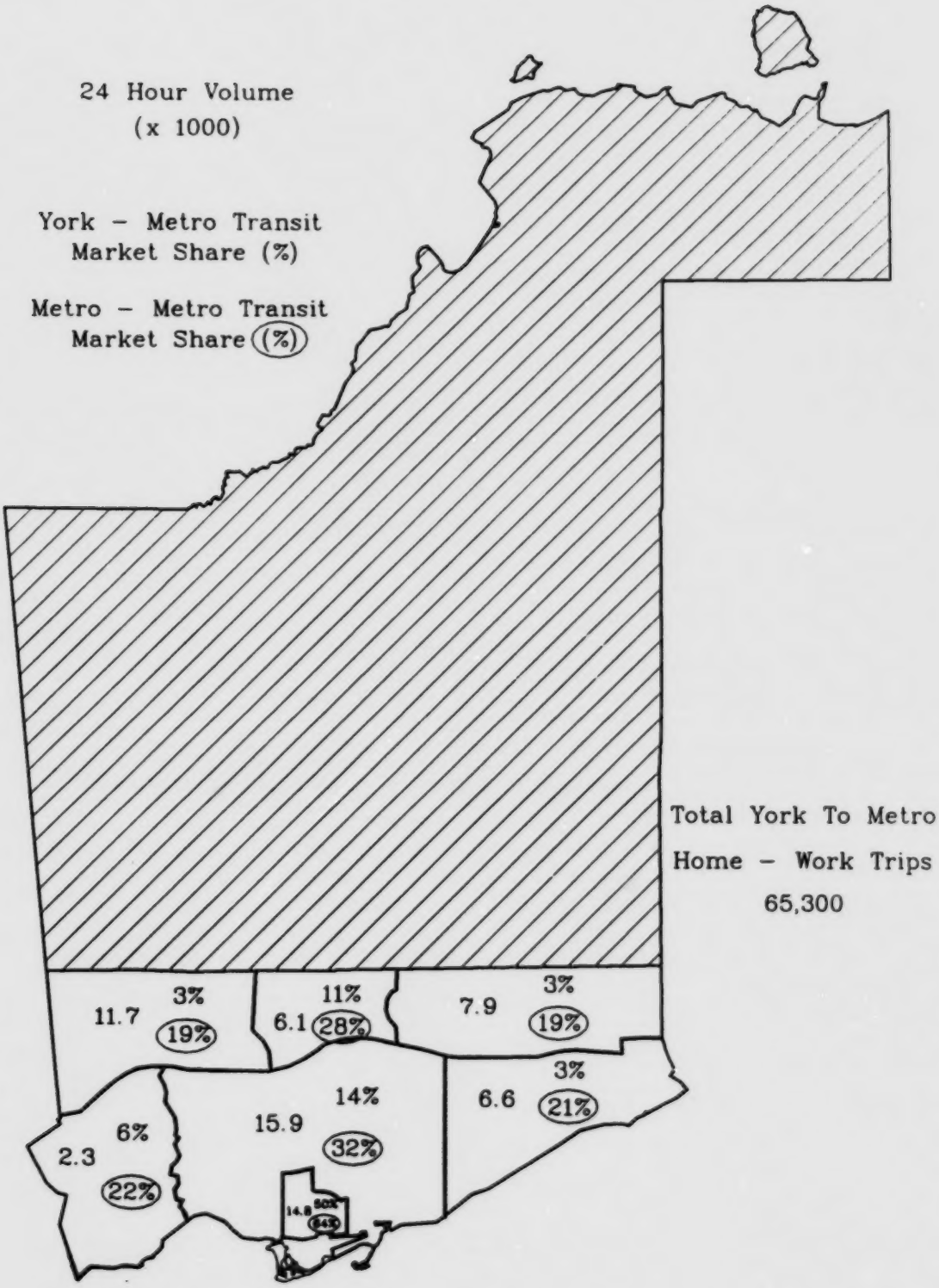
Whereas transit accommodates a large proportion of work trips from York Region to the Central Area (50% versus 64% for work trips originating within Metro), transit mode shares from York to other Metro destinations are less than half of the Metro to Metro mode splits. Substantial increases in transit use might be possible for those cross-boundary trips to Metro from York, which do not end in the Central Area, assuming that transit services in south York Region are improved to Metropolitan Toronto levels. However, land use and socio-economic factors will likely keep transit ridership from York to Metro suburban areas at lower levels than are currently observed within Metropolitan Toronto.

The arrangement of land uses and the design of street patterns within the rapidly developing residential and employment areas within York Region makes it difficult and expensive to offer high levels of transit service, even though, as discussed in Chapter 3, proposals for the development of expanded transit services are now being considered. The provision of good pedestrian access to/from places of residence and employment is difficult where street systems are planned to discourage through traffic. Transit potential is further reduced by the fact that York Region auto ownership is high at .91 cars per licensed driver. This figure compares to .77 cars per licensed driver in Metropolitan Toronto. Sixty eight per cent of York Region households have 2 or more cars available. In contrast, only 32 per cent of Metro households have 2 or more cars available for their personal use.

In the case of school travel, transit use from York Region to Metro Toronto is generally high. Depending on the destination, transit serves between 30 and 75 per cent of school trips from York to Metro, with the highest market share for travel to Central Area

Exhibit 2.1

1986 Home to Work Travel
York to Metro



institutions such as the University of Toronto and Ryerson. By contrast, transit use for work trips to York to the concentration of work destinations in the developed parts of Vaughan and Markham and Central York (Thornhill, Richmond Hill, Aurora and Newmarket), are generally low, with the highest transit use being to the Central York area, which has the highest level of transit service.

In order to better understand the nature of peak period trips across the Metro Boundary and the potential role that various transit alternatives might play in increasing transit use, the distribution of home to work trips between York Region and Metro was reviewed. As part of this review the current role of transit in serving specific movements was identified. This analysis made use of planning district level data for the 33 districts illustrated in Exhibit 2.2.

Work Travel From York Region To Metro

The analysis of 1986 travel patterns made use of assignments of 1986 home to work travel to a simplified "spider" network. Exhibit 2.3 shows York to Metro home to work trips in relation to total home to work travel demands. For historical reasons related to the development of transportation facilities and settlement patterns, the dominant work travel patterns are north-south, rather than east-west. The work travel patterns illustrated in Exhibit 2.7 suggest that travel between York and Metro can be described in terms of three major north-south travel markets:

1. A Central York-Central Area travel market, which includes Newmarket, Aurora, Richmond Hill and Thornhill, east and west, wherein travel is primarily oriented to jobs in North Central Metro, Inner Metro and the Central Area, (Districts 11, 4, and 1 in Exhibit 2.2);

2. A Markham-Scarborough-Don Valley-Central Area travel market, wherein travel is primarily oriented from Markham, excluding Thornhill East, to Scarborough, the Don Valley corridor and the Central Area (Districts 16, 13, 12, 5 and 1 in Exhibit 2.2); and

3. A Vaughan-North West Metro travel market, wherein the majority of work travel is between homes in Woodbridge, Maple and other Vaughan communities and Jobs in North-West Metro (Districts 9, 10, and 3), with relatively few trips going as far as the Central Area.

The three major cross-boundary travel markets are defined by both land use and travel patterns. Independent residential communities in York Region, including Woodbridge, Thornhill, Richmond Hill, Markham and Unionville, are expanding, sometimes growing

Exhibit 2.2

North Metro Boundary
Transportation Review Districts

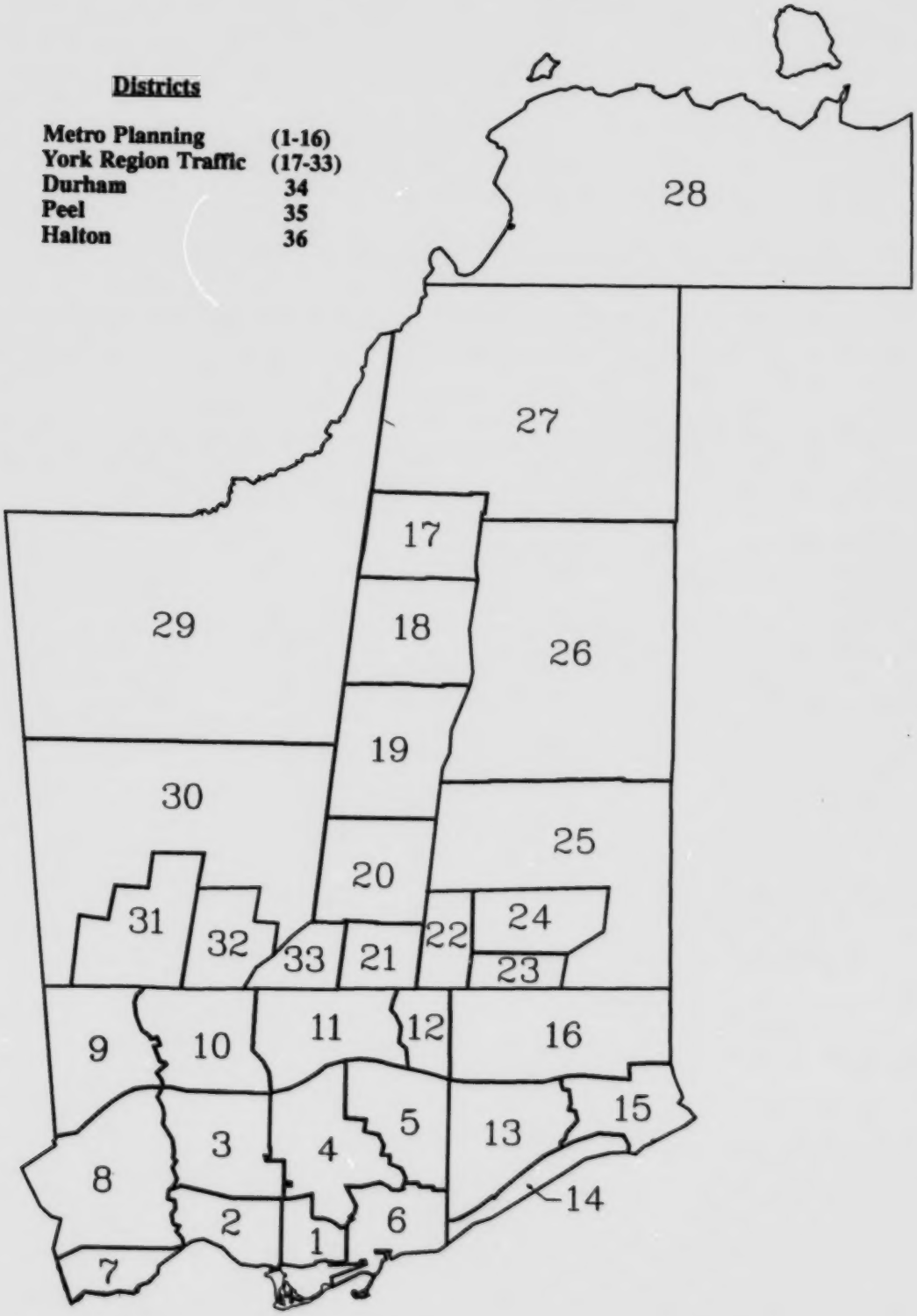


Exhibit 2.3

1986 Daily Home to Work Trip Assignment

together, as in the case of Markham-Unionville and Richmond Hill-Thornhill. Current and planned industrial and commercial developments separate these growing residential areas, as shown in Exhibit 2.4, creating three separate residential service areas. As discussed below, each of the three service areas has distinct travel patterns and, therefore, special transportation requirements.

Central York - Metro

Half of all work travel from Central York to Metro is destined for the Central Area and other employment concentrations served by the Yonge-University-Spadina Subway system. Travel between Central York and these destinations defines a strong transit travel corridor, in that these employment concentrations attract a high proportion of non-captive riders[1]. Half of the remaining Central York to Metro work travel is destined to areas north of Highway 401 (Districts 10, 12 and 16 in Exhibit 2.2), which are not served by rapid transit, at this time.

Markham - Metro

Eighty per cent of work travel from Markham residential areas (excluding Thornhill East) to Metro is destined for Scarborough (Districts 16 and 13), the Don Valley Corridor (Districts 5 and 12) and the Central Area (District 1). Travel to the Central area is served by bus (to the Scarborough RT and the Yonge and Bloor-Danforth subway lines), and the Stouffville commuter rail line, which presently provides 1 train per day in each direction.

Vaughan - Metro

Sixty per cent of work travel from Vaughan residential areas (excluding Thornhill West) to Metro is destined for Rexdale, Downsview and Northwest Toronto/York (Districts 9, 10 and 3). A further 13 per cent of work travel is destined for the Central Area (approximately 800 trips in 1986).

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[1] "Passenger captives", persons without a drivers licence or access to a car, account for 47 % of work trips to District 1, the Central Area, 58% of trips to District 4, the North Toronto area, and 62% of trips to District 11, the area which includes the North York City Centre. Seventy to eighty per cent of work trips to other Metro employment districts are made by passenger captives.

Exhibit 2.4

South York Region Future Land Use

Work Travel From Metro to York

Exhibit 2.5 illustrates the travel patterns of Metro residents who work in York Region in relation to total 1986 home to work demands. These travel patterns define two additional north-south travel markets oriented to York Region employment areas:

1. A Northwest Metro to Vaughan travel market oriented to jobs in the Vaughan Industrial Areas; and,

2. A Northeast Metro to Markham travel market oriented to jobs in the Markham Industrial/Commercial Area.

Travel from Metro to jobs in Central York (Thornhill and Richmond Hill), defines a third outbound travel market but this market does not constitute a separate transit service area. Outbound work travel demands in the Central York area can be (and are) largely served by the transit lines which bring Central York residents to jobs and schools in Metro Toronto.

Most Metro residents who work in the Central York Corridor reside in central Metro (District 4) and suburban Metro, north of Highway 401 (Districts 9, 10, 11, 12 and 16). These areas account for 85% of Metro work trip origins to Central York. The Metro-Central York demand is relatively well served by the feeder bus network which brings York residents to jobs in Metro. Therefore, this outbound demand appears to fit within the previously defined Central York-Central Area Corridor.

Metro workers travelling to Vaughan industries come from the same general areas where Vaughan residents work (i.e., Northwest Metro). However, most Metro residents working in Vaughan cannot make use of the same north-south bus services that would serve Vaughan residents travelling to their jobs in Metro. Therefore, these outbound travel demands give rise to a forth north-south transit travel market in the Weston Road to Keele Street area.

Metro workers travelling to the Markham Industrial-Commercial area (between Highway 404 and Warden Avenue) tend to originate in the same general areas where urban Markham residents work (the Don Valley corridor and Scarborough). However, most Metro

Exhibit 2.5

1986 Daily Home to Work Trip Assignment

workers commuting to Markham cannot make use of the north-south bus services that serve Markham residents who work in Scarborough, or provide connections to rapid transit services and the Central Area. Therefore, these outbound work trips define a fifth north-south travel market in the Highway 404 to Warden area.

Summary - Transit Service Requirements

The five travel markets identified above have different transit service requirements. The Central York - Central Area Corridor requires good connections to the Central Area (via Commuter Rail and/or subway) and to office commercial concentrations on the Yonge Subway, north of the Central Area. In addition, Central York commuters would benefit from improved transit access to other dispersed employment areas in north-central Metro (north of Highway 401). Travel from the Vaughan travel market is primarily oriented southward to Rexdale, Downsview and the City of York, suggesting the need for improved north-south bus services. Travel from the Markham travel market is oriented to the Central Area, and suburban employment areas in Scarborough and the Don Valley Corridor, requiring a combination of bus and rail services.

York to Metro school travel patterns are consistent with the commuting patterns of York residents working in Metro. Services designed to serve York Region commuters in the three Metro-Oriented travel markets would also serve the major school demands.

Work travel from Metro to York region employment areas is not oriented to existing or proposed rapid transit or commuter rail lines. Travel from northwest Metro to Vaughan industries and from northeast Metro to Markham industries would be better served by improved bus services than by fixed-route transit, given the relatively wide distribution of origins and the low densities at the employment end of these outbound work trips.

Projected 2001 and 2011 Travel Demands

The 1986 Transportation Tomorrow Survey Home to Work trip table was updated to 2001 and 2011 using the Fratar "growth factor" method and the population, employment growth estimates documented in Exhibit 2.6. The 2001 and 2011 forecasts of home to work travel were analyzed to assess future peak period travel and transit demands, focusing on the basic travel markets defined above.

Exhibit 2.6

Assumed Population/Employment Changes Within Study Area 1986 to 2001/2011

	1986-2001 Increases		1986-2011 Increases	
	Population	Employment	Population	Employment
Metro Toronto				
Total	57,600	175,000	107,600	263,400
PD 1 (Central area)*	31,500	59,400	35,500	89,700
PD 11 (incl North York City Centre)*	23,400	20,000	31,400	28,800
PD 13 (incl Scarborough City Centre)*	-3,000	21,500	3,000	31,300
York				
Total	290,800	187,300	438,800	299,100
Newmarket/Aurora*	35,200	19,000	52,500	30,400
Richmond Hill*	79,700	27,000	120,400	42,600
Markham*	68,900	64,200	103,600	104,000
Vaughan*	83,000	73,000	125,800	115,600
Durham	153,700	58,400	223,700	78,400
Peel	257,500	122,800	321,500	152,800
Halton	98,600	51,500	163,600	66,500
5 Region Total	858,400	595,100	1,255,000	850,000

*Major population and/or employment sub-areas

The 2001 and 2011 forecasts reflect land use assumptions which were consistent with the most current data available for Metro and York in May, 1989. These population and employment forecasts have currently been revised as part of ongoing studies being conducted by the Greater Toronto Coordinating Committee and other agencies. Changes in future population and employment projections for the study area can be expected to change the travel forecasts. Proposed developments such as the Seaton new town in North Pickering were not considered directly in assessing future cross-boundary travel demands between York and Metro.

The 2001 and 2011 demand estimates were assigned to a spider network, in order to illustrate the structure of cross-boundary travel demands and estimate the rate of growth in cross boundary travel for distinct sections of the North Metro Boundary. These spider assignments illustrate travel demand desires, as opposed to the actual routes which will be chosen by cross-boundary commuters. These assignments are intended to depict the peak period travel patterns that will have to be served by transit, if the transit option is to compete more effectively with the car. The 2001 and 2011 assignments were also used to estimate the increase in daily home to work travel (and peak hour demand) across sections of the North-Metro boundary.

The 2011 results are summarized in Exhibits 2.7 and 2.8 which present spider network assignments for work travel from York to Metro and Metro to York for 2011, and Exhibit 2.9, which summarizes the cross-boundary travel in 1986, 2001 and 2011 for three sections of the York-Metro boundary.

Conclusions

The 2001/2011 work trip assignments support the characterization of cross-boundary travel in terms of the 5 travel markets identified previously, based on the analysis of 1986 TTS data:

1. Central York - Central Metro
2. Markham-Scarborough-Central Area
3. Vaughan-Northwest Metro
4. Northwest Metro-Vaughan Industrial
5. Northeast Metro-Markham Industrial/Commercial

Exhibit 2.7

2011 Daily Home to Work Trip Assignment

Exhibit 2.8

2011 Daily Home to Work Trip Assignment

Exhibit 2.9

Home to Work Travel Forecast Summary

Screenline Section	Home to Work Trips 1986-2011			Estimated Growth Factors	
	1986TTS	2001	2011	2001/1986	2011/19
(York to Metro Flows)					
Vaughan to Metro (427 to Keele)	9,288	15,352	17,325	1.65	1.87
Central York To Metro (Dufferin to Don Mills)	34,979	49,928	55,462	1.43	1.59
Markham to Metro (404 to 9th Line)	21,090	34,633	39,668	1.64	1.88
Totals	65,357	99,913	112,455	1.53	1.72
(Metro to York Flows)					
Metro to Vaughan (427 to Keele)	14,899	27,326	32,433	1.83	2.18
Metro to Central York (Dufferin to Don Mills)	17,535	28,746	35,561	1.64	2.03
Metro to Markham (404 to 9th Line)	21,283	31,701	36,405	1.49	1.71
Totals	53,717	87,773	104,399	1.63	1.94

*Growth factors estimated based on assigned flows for home-to-work trips.

The assignments imply continu[illegible]rowth in cross-boundary travel within all five travel markets. They suggest that travel [illegible]n Central York and Markham to the Central Area (District 1) will continue to increase during the planning period, while travel from suburban Metro to the Central Area can be expected to stabilize.

The principle changes in travel patterns in the period 1986 to 2011 relate to travel from Metro to the developing industrial/commercial areas in Vaughan. As industrial and commercial development proceeds north of Steeles Avenue, particularly in the Woodbridge area (District 31 in Exhibit 2.3), the pattern of outbound travel and traffic will become more dispersed. The forecast travel patterns will create two-way ridership opportunities for future north-south bus routes serving Woodbridge residents.

The comparison of 1986, 2001 and 2011 assignments shows the relative growth of cross-boundary and internal Metro to Metro travel demands, given the land use assumptions. Exhibit 2.9 illustrates the estimated growth in cross-boundary travel by screenline section in terms of daily home to work trips in 1986, 2001 and 2011 and proportionate increases in 1986 work travel to 2001 and 2011.

The 2001 forecasts suggest that home to work trips from York Region to Metro can be expected to increase by 53 per cent between 1986 and 2001 and that home to work travel from Metro to York Region can be expected to increase by 63 per cent during same period.

The 2011 forecasts suggest that home to work trips from York Region to Metro will increase by 72 per cent between 1986 and 2011. Home to work travel from Metro to York Region can be expected to increase by 94 per cent during the same period, based on the 2011 forecasts. Peak period travel across the North Metro boundary can be expected to increase in direct proportion to the increase in home to work travel.

Estimated inbound work travel increases vary from 43 per cent (by 2001) and 59 per cent (by 2011), in the Central York to Metro corridor, to 64 and 88 per cent in the Markham to Metro travel market. Outbound home to work demand increases are larger,

with projected demands in the Metro to Vaughan and Metro to Central York markets more than doubling by 2011.

The projected work travel increases in the largest Central York to Metro travel market (59 per cent to 2011) amounts to over 20,000 daily home to work trips between 1986 and 2011. The estimated increase in daily home to work trips suggests a total increase of approximately 14,000 AM peak hour person trips within the Central York - Central Area corridor, between 1986 and 2011.

2.2 Transit Potential

Given the projected increase in cross-boundary and other travel in the study area, substantial increases in transit use can be expected in relation to 1986 travel, particularly from York to Metro for work travel, *if service levels are increased to current Metro Toronto standards.*

In order to assess transit ridership potential, future market shares (mode splits) were estimated for York to Metro origin-destination pairs and applied to 2001 and 2011 home to work travel forecasts. Where observed 1986 mode splits reflect poor service, such as from Woodbridge and Markham-Unionville to the Central Area, mode split factors were increased. The mode split assumptions reflect the market penetration achieved in other parts of the region which have high levels of commuter rail or feeder bus service and similar land use and socio-economic characteristics. These estimates recognize that the high auto ownership exhibited by York Region residents and low residential densities will tend to limit future transit ridership from York to suburban employment areas within Metro.

The resultant estimates of future transit ridership potential are summarized in Exhibit 2.10 which refers to the three York to Metro travel markets that have the greatest transit potential and could be expected to benefit from improved fixed route transit services. Transit ridership potential for travel between York and Metro is discussed in more detail below.

Exhibit 2.10

Transit Ridership Potential
(AM peak hour person trips)

Central York - Central Area Corridor

1986	5,200*
2001	12,500 (6000 to C.A.) (1400 from Newmarket-Aurora)
2011	14,000 (6700 to C.A.) (1600 from Newmarket-Aurora)

Markham - Don Valley - Central Area Market

1986	1,500*
2001	4,500 (2600 to C.A.)
2011	5,100 (3000 to C.A.)

Vaughan - North West Metro Market

1986	600*
2001	1,800 (600 to C.A.)
2011	2,000 (700 to C.A.)

* 1986 figures based on reported TTS results and include persons walking to Steeles Avenue to use TTC services as well as bus and Commuter Rail traffic across the boundary. Note that the TTS results may understate the actual cross-boundary transit travel, particularly between Vaughan, west of Dufferin Street, and Metro.

Central York - Metro

From the transit service perspective, the Central York - Central Area corridor has the greatest potential for increased transit ridership, assuming appropriate services are provided. There is strong demand forecast from Thornhill, Richmond Hill, Aurora and Newmarket to jobs in North Central Metro (and the developing North York Centre) and to the major employment concentrations on the Yonge Subway from York Mills to the Downtown.

The 2001 and 2011 assignments suggest that total home to work movements in the Central York corridor at Steeles will increase from 35,000 to 50,000 between 1986 and 2001. By 2011 the total inbound movements within the corridor will increase to more than 55,000 daily home to work trips. A large proportion of these trips can be attracted to transit, assuming that accessible, direct and frequent transit connections are provided.

Current transit use for home to work trips from the Central York Corridor to the Metro Toronto's Yonge Street Corridor range from 58 per cent, for jobs in the Central Area (District 1), to 30 per cent for jobs in District 4 (which includes Yonge/St. Clair and Yonge/Eglinton) and 13 per cent for jobs in District 11 (which includes the North York Centre).

Assuming the provision of competitive transit services, mode splits from Central York to the Central Area can be expected to increase from 58 per cent to approximately 65 per cent, based on observed transit use from other parts of the GTA which have higher levels of transit service.

Proportionately larger increases in transit market share can be expected to employment locations north of the Central Area. Given competitive transit services, mode splits from Central York to District 4 can be expected to increase from 30 per cent, in 1986, to approximately 50 per cent, by 2001/2011. Mode splits for work trips to District 11 can be expected to increase from 13 per cent to between 35 and 50 per cent, depending upon land use and transit service development related to the North York City Centre.

The transit ridership potential of travel from Central York to North Central Metro (District 11) is illustrated by the fact that approximately 40 per cent of the employees working in the Yonge/Sheppard and Yonge/Finch areas are currently using transit (according

to a recent survey conducted by North York). Approximately 28 per cent of Metro residents who work in the larger District 11 area travel to work by transit.

Improved transit services will be required from Central York to the Yonge subway, to support increased transit use to employment areas in the Yonge Street Corridor (north of Bloor Street). Also, if total demand south of Bloor Station increases (and the capacity of the Yonge subway south of Bloor Station is not increased), improved alternative transit services will be required from Central York to the Downtown-Midtown employment areas, south of Bloor. Expanded commuter rail services or improved connections to the Spadina subway are possible alternatives to increasing the capacity of the Yonge line, if peak hour Yonge subway volumes south of Bloor Station increase in the future.[1]

The peak hour transit ridership estimates summarized in Exhibit 2.10 assume that the required improvements in transit service are provided.[2] The results, which reflect total peak hour transit travel and not just home to work trips, indicate that potential peak hour transit use in the Central York-Central Area Corridor is approximately 12,500 by 2001 and up to 14,000 by 2011. Approximately half of the identified potential transit ridership is destined for the Central Area. Only 12 per cent of identified Central York transit potential originates in Newmarket and Aurora.

Markham - Metro

The transit ridership potential in the other York to Metro travel markets is much lower than for the Central York Corridor. The transit ridership potential of the Urban Markham travel market (Districts 23 and 24) is greater than that of the Woodbridge travel market. The Markham-Metro demands are primarily oriented to jobs in Agincourt (District 16), Central Scarborough (District 13), the Don Valley Corridor (Districts 5 and 12), and the Central Area (District 1). Therefore, a combination of services will be required to improve transit's market share, including more frequent north-south bus services and

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[1] Peak hour ridership on the Yonge Line south of Bloor has actually declined since 1981/82, despite the continued growth of ridership south from Finch Station and the other suburban terminals of the subway system.

[2] The estimates presented in Exhibit 2.10 are based on factoring total projected home to work travel flows by .65 to approximate total peak hour transit demands for all purposes. The .65 factor reflects the observed relationship between observed work travel and current peak hour transit demands at the Metro/York boundary.

(possibly) commuter rail or rapid transit facilities (to serve the Downtown-Midtown area and employment concentrations in the Don Valley corridor).

Despite high incomes and high auto ownership, Markham's relatively high Central Area orientation translates into high transit ridership potential. Approximately 60 per cent of the estimated potential inbound transit ridership from Markham is destined for the Central Area. Potential peak hour ridership from Markham to Metro is approximately 6000 by 2011.

Vaughan - Metro

The role of transit service from Woodbridge (District 31) and other Vaughan residential districts to Northwest Metro is limited by high income/high auto ownership, low residential densities and the dispersed, auto-oriented employment destinations of Vaughan residents. Rapid transit and commuter rail options are relevant to less than 10 per cent of the peak period demands originating in the Vaughan area. Improved north-south bus services are required to carry Vaughan residents to jobs in Downsview (District 10), Rexdale (District 9) and Inner Metro (particularly District 3).

Potential ridership from Vaughan to Metro is approximately 2000 by 2011, one third of which is destined for Toronto's Central Area.

Metro to York

Transit ridership potential in the two primarily outbound (Metro to York) corridors is limited, given the nature of the jobs and land uses in the major industrial/commercial areas in Vaughan and Markham. Rapid transit and commuter rail options do not address the needs of Metro residents working in Vaughan or Markham, given the dispersed origins and destinations of outbound work trips. However, the Metro experience with the TTC's relatively dense grid of frequent suburban services suggests that it should be possible to increase current mode splits from Metro to the major York employment areas with improved north-south bus services (from less than 10 per cent at present to between 15 and 20 per cent by 2001).

2.3 Road Deficiencies and their Implications for Transit Needs

AM peak hour road traffic has been estimated based on the projected growth in home to work travel between York Region and Metro Toronto to 2011. Estimates of 1986-87 road traffic presented in Exhibit 2.11 were developed based on Metro cordon count data for 1987.

The 2001/2011 forecasts of road traffic by screenline section were developed based on the estimated 1986 to 2001 and 2011 growth in home to work travel (by screenline section). The 2001/2011 estimates presented in Exhibits 2.11 and 2.12 (which provides a graphic summary of the demand/capacity analysis) assume no changes in either transit use or auto occupancy or in the propensity of Central York residents who drive to use Provincial highways to travel to jobs in Metropolitan Toronto.[1] They also assume no changes in the relationship between daily home to work trip making and total AM peak hour demands at the Metro boundary.

The comparison of demand and capacity summarized in Exhibit 2.12 and detailed in Exhibit 2.11 indicates that AM peak hour traffic across the north Metro boundary will exceed available 1989 capacity in both directions. Projected 2001 inbound AM peak hour demands exceed 1989 capacity by approximately 16,000 vehicles (auto equivalents). Projected 2001 AM Peak Hour outbound demands exceed 1989 capacity by 6000 vehicles.

Projected 2011 inbound AM peak hour demands exceed 1989 capacity by approximately 22,000 vehicles. Projected 2011 outbound AM peak hour demands exceed 1989 capacity by approximately 15,000 vehicles.

The inbound capacity shortfall across the already congested Dufferin to Don Mills/Leslie section of the boundary (those facilities which serve the Central York Travel Market), before considering any increase to existing road capacity, would be in the order of 4000 peak hour vehicles by 2001 and over 5000 by 2011.

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[1] Given the trend toward lower auto occupancy (from 1.238 in 1975 to 1.197 in 1987 at the Metro boundary cordon) the auto occupancy assumption may understate future travel demands. Also, improved transit service, particularly in the Central York to Central Area corridor, could be expected to reduce auto demands in other corridors.

Exhibit 2.11

Metro-York Cross Boundary Demand/Capacity Summary

(Peak Hour Demand Relative to 1989 Capacity at Steeles Ave.)
(Auto vehicle equivalents)

SCREENLINE (roads included)	CAPACITY* (1989)	DEMAND (estimated) (1986-87)	FUTURE DEMAND (approximate) 2001 (V/C)	2011 (V/C)
Hwy 427 to Keele	12,300	SB 11,600	19,000 (1.54)	21,700 (1.76)
		NB 7,800	14,300 (1.16)	17,000 (1.38)
Dufferin to Don Mills/ Leslie	9,750	SB 9,800	14,000 (1.44)	15,600 (1.60)
		NB 5,000	8,200 (.84)	10,200 (1.05)
Hwy 404 to Ninth Line	13,500	SB 11,300	18,500 (1.37)	21,200 (1.57)
		NB 12,700	18,900 (1.40)	21,700 (1.61)
TOTALS	35,550	SB 32,700	51,500 (1.45)	58,500 (1.65)
		NB 25,500	41,400 (1.16)	48,900 (1.38)

* Capacity of existing roads at Level of Service D.

Metro-York Cross Boundary Demand/Capacity Summary

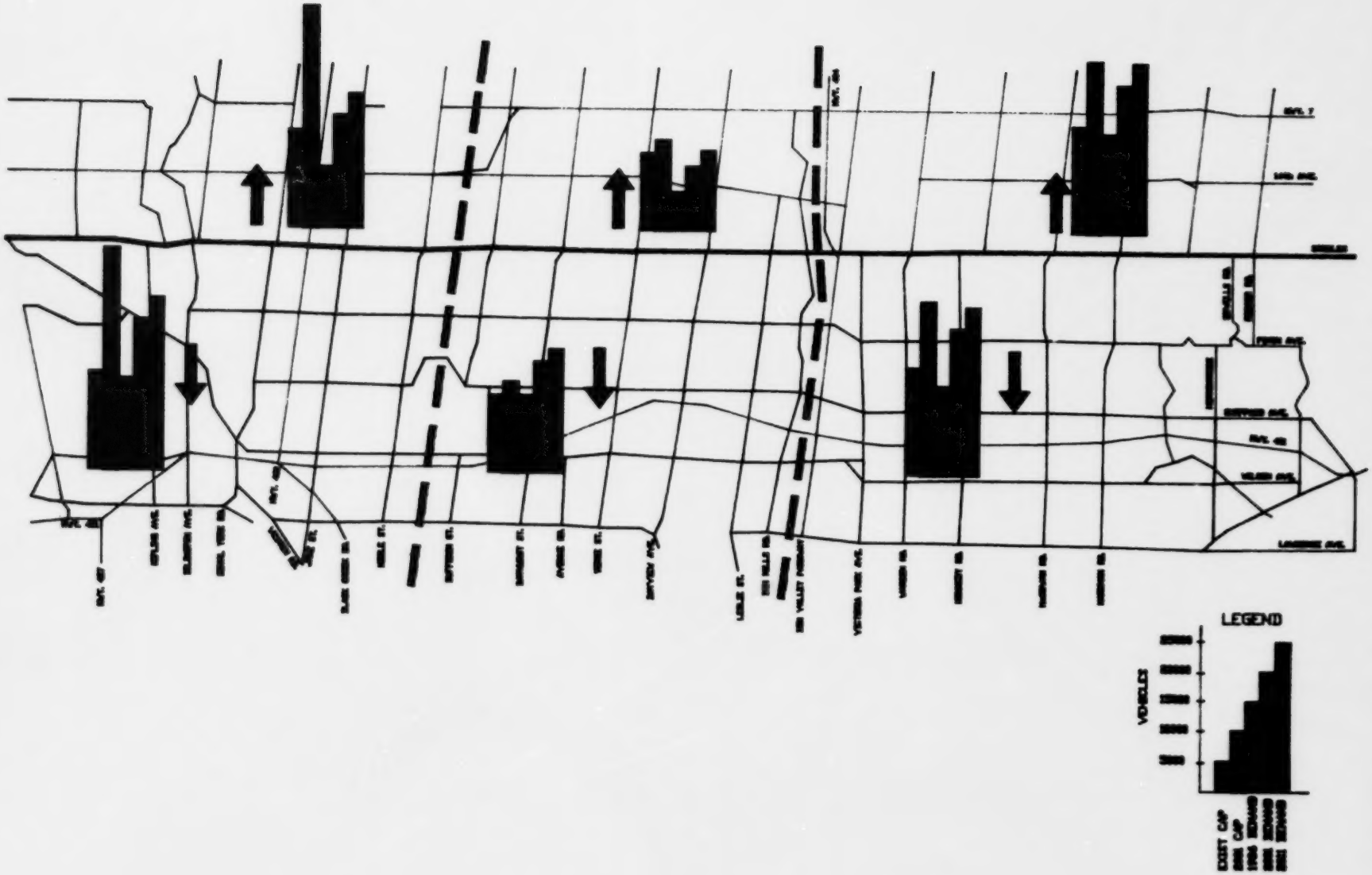
(Peak Hour Demand Relative to Planned 2001 Capacity at Steeles Ave.)
(Auto vehicle equivalents)

SCREENLINE (roads included)	CAPACITY* (2001)	DEMAND (estimated) (1986-87)	FUTURE DEMAND (approximate) 2001 (V/C)	2011 (V/C)
Hwy 427 to Keele	27,750	SB 11,600	19,000 (.72)	21,700 (.78)
		NB 7,800	14,300 (.52)	17,000 (.61)
Dufferin to Don Mills/ Leslie	11,400	SB 9,800	14,000 (1.23)	15,600 (1.37)
		NB 5,000	8,200 (.72)	10,200 (.89)
Hwy 404 to Ninth Line	21,750	SB 11,300	18,500 (.85)	21,200 (.97)
		NB 12,700	18,900 (.87)	21,700 (1.00)
TOTALS	60,900	SB 32,700	51,500 (.85)	58,500 (.96)
		NB 25,500	41,400 (.68)	48,900 (.80)

* Capacity of existing and planned roads at Level of Service D, assuming all planned lanes are available for auto traffic.

Exhibit 2.12

North Metro Boundary Review
Peak Hour Demand/Capacity Summary



The 1989 road capacity in the Central York Travel Market is sufficient to accommodate projected AM peak hour outbound travel to 2001 but not to 2011. However, planned increases in capacity appear to be sufficient to accommodate projected outbound traffic to 2011. *With planned road improvements*, the capacity shortfall would drop to 2600 peak hour vehicles in 2001 or 3800 in 2011. Exhibit 2.11 presents 2001 and 2011 demands relative to 2001 capacity. Exhibit 2.12 summarizes the results in relation to both 1989 and planned 2001 road capacity.

Projected AM peak hour demands across the Highway 404 to Ninth Line Screenline (serving the inbound and outbound Markham-Metro travel markets) and the Highway 27 to Keele Screenline (serving the inbound and outbound Vaughan-Metro travel markets) would exceed 1989 capacity in both directions. However, overall, planned increases in road capacity shown in Exhibit 2.11 appear to be sufficient to accommodated projected increases in AM peak hour demand *at the North Metro boundary* to 2011, although there will undoubtedly be capacity deficiencies at specific points due to the uneven distribution of travel demand along the screenline. The Markham screenline (Highway 404 to Ninth Line) would be at capacity by 2011, based on the current forecasts.

Note that the demand analysis of this study did not explicitly consider the effects of the planned community of Seaton in North Pickering on cross boundary travel between York and Metro. This development, which only emerged as a provincial priority after the demand analysis had been completed, would greatly increase north-south travel across the Markham-Scarborough boundary. Therefore, it was necessary to consider the implications of a Seaton community of 20,000 to 90,000 on cross boundary traffic and travel to 2011.

Based on peak hour demand estimates provided by the Proctor and Redfern Group, which is undertaking the *East Metro Corridor Travel Demand Study*, it appears that the conclusions of the current study with respect to roadway demand and capacity would not be substantially affected *if the proposed EMTC were built and Seaton were limited to a population of 90,000*. The majority of traffic originating in Seaton (75%) would use the EMTC rather than the north-south arterials between Victoria Park Road and the 9th Line (the Markham screenline of the current study). However, should Seaton proceed without the EMTC or comparable roads, peak hour cross boundary demand would likely exceed the capacity of the planned arterial road system serving Markham and North Scarborough by

approximately 6000 vehicles. These additional auto trips would not be attracted to cross boundary transit services designed to capture transit potential within the North Boundary Study area.

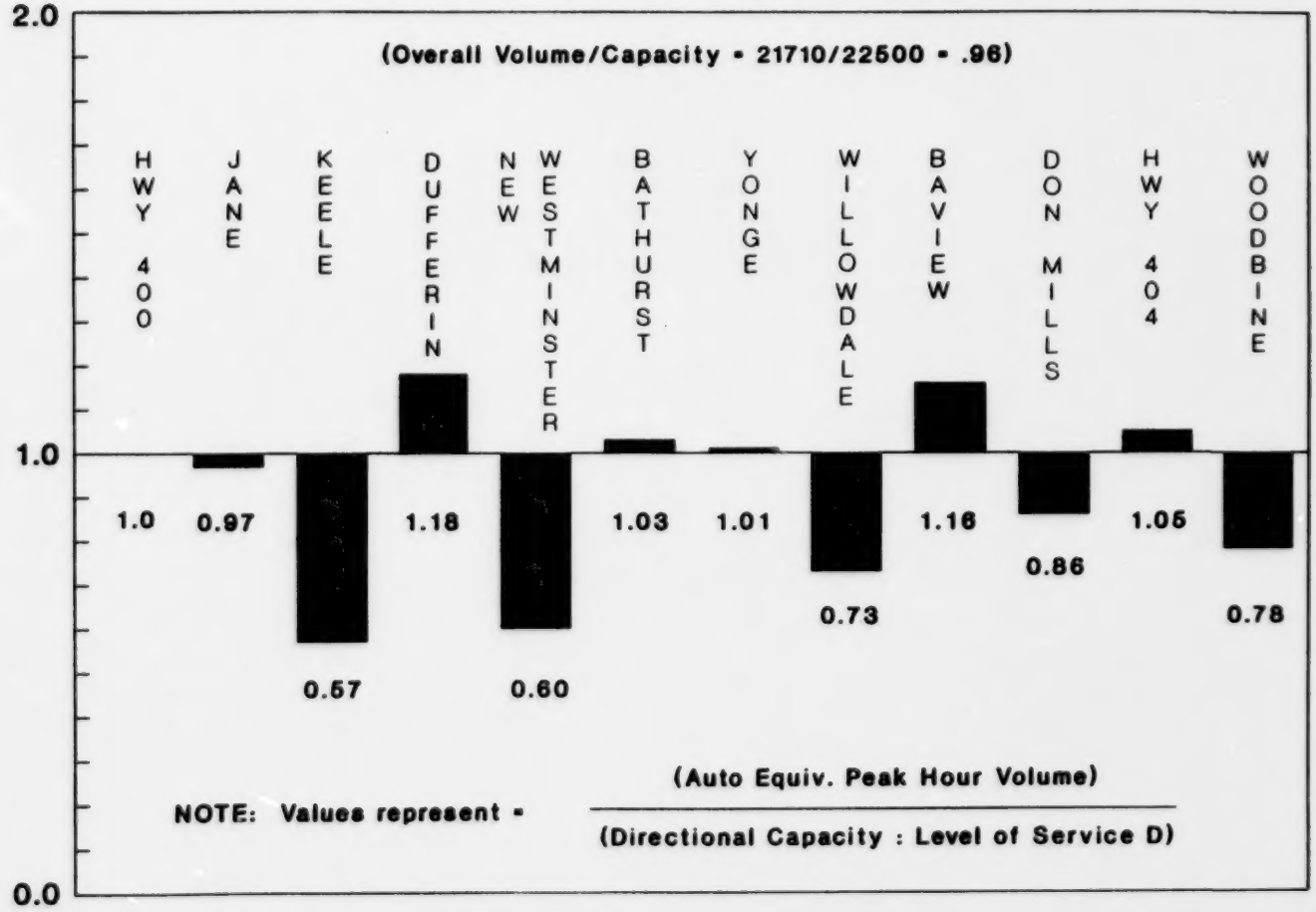
Planned increases in road capacity appear to be sufficient to accommodate projected inbound and outbound demands across the Vaughan and Markham screenlines, if travel is evenly distributed over available facilities. However, current and future demands are concentrated in different areas and use different roads. For example, AM peak period traffic on Keele Street, Woodbine, Victoria Park, Esna Park and Warden is primarily outbound, serving commuters destined for jobs in the Vaughan and Markham Industrial areas. Travel on Dufferin, Bathurst, Yonge, Bayview, Don Mills, Kennedy and Brimley is primarily inbound, serving Thornhill and Markham commuters destined for jobs in Metropolitan Toronto. Therefore, facilities serving specific travel markets will likely become more congested in the future, even if all planned road improvements are implemented.

The demand analysis demonstrates that major increases in North Metro Boundary road capacity will be required by 2001, to accommodate projected increases in peak period travel and traffic. The current demand/capacity situation is critical in the central York Corridor, as shown in Exhibit 2.13, which shows 1987 volume/capacity ratios for individual north-south streets between Highway 401 on the West and Woodbine Avenue on the East. Whereas the overall southbound AM peak hour Volume/Capacity ratio is .97 at level of service D, most major streets were at or above capacity in 1987.

Given the assumed population and employment forecasts and *planned* road capacity, there will be sufficient aggregate road capacity to accommodate projected increases in cross-boundary travel at the Metro boundary, assuming that the Seaton community does not proceed without the planned EMTC. However, road facilities in specific corridors will become increasingly congested. Our analysis has not considered the ability of the Metro Toronto road network to accommodate the 53 per cent increase in York to Metro travel demand projected for the 1986-2001 period and the 72 per cent increase in York to Metro travel projected for the 1986-2011 period.

The Demand/Capacity analysis summarized graphically in Exhibit 2.12 suggests that the major road capacity problem relates to an AM peak hour inbound road capacity shortfall across the Dufferin to Don Mills screenline (serving the Central York travel market). The

Exhibit 2.13
1987 A.M. Peak Hour Inbound Road Volume And Capacity at Steeles Avenue



analysis indicates the demand will exceed capacity by 2600 autos by 2001 (equivalent to 3100 peak hour person trips). If this shortfall is to be accommodated by diverting auto travel to transit, AM peak hour transit use from Central York to Metro will have to increase from 5200 (in 1987) to 9800 (in 2001). AM peak period transit market share (mode split) at Steeles Avenue for work travel in the Central York-Central Area corridor would have to increase from approximately 23 per cent (in 1987) to approximately 34 per cent in 2001, in order to reduce projected AM peak hour traffic by 2600 cars.

The estimated Central York capacity shortfall to 2011 is 4200 cars or approximately 5000 person trips, which suggests that total peak hour transit use in the Central York - Central Area corridor should increase to approximately 12,000 by 2011 (consistent with a work travel mode split of 39 per cent). The estimates of road and transit demand and capacity and auto trips diverted to transit are summarized in Exhibit 2.14.

Transit service to and from Vaughan and Markham is less a matter of insufficient road capacity, as planned road capacity increases appear to be generally consistent with projected increases in peak hour traffic. However, increases in transit market shares will also be required in the Vaughan to Metro and Markham to Metro travel markets, to reduce auto traffic in Metro.

Improved transit services between developing residential areas in Vaughan and Markham and relevant employment areas within Metro can be expected to increase current transit market shares for cross-boundary travel from Vaughan and Markham from the current 8 per cent mode splits to approximately 15 per cent, as discussed in Section 2.2. Markham to Metro travel patterns are better suited to fixed-route transit service options such as commuter rail, because of the greater number of Central Area commuters.

Travel from Metro to Vaughan and Markham is difficult to serve with transit, given the dispersed trip origins and destinations and the low density of south York Region employment areas. However, because current transit use from Metro to Vaughan and Metro to Markham is very low, mode splits can also be expected to increase, if Metro transit services are extended into Vaughan employment areas and service levels are improved consistent with service levels in suburban employment areas within Metro.

Exhibit 2.14

Demand/Capacity Analysis

Transit Implications
(At Steeles Avenue)

SCREENLINE -->	VAUGHAN-METRO	CENTRAL YORK-METRO	MARKHAM-METRO
1987 AM Peak Hour			
Auto Demand	11,600	9,800	11,300
Transit Demand			
(AM Peak Hour)			
volume*	600	5,200	1,500
% using transit	(10)	(23)	(11)
Road Capacity			
1989	12,300	9,750	13,500
2001	27,750	11,400	21,750
2001 Demand			
Auto	19,000	14,000	18,500
Transit**	(1,000)	(6,700)	(2,400)
2011 Demand			
Auto	21,700	15,600	21,200
Transit**	(1,100)	(7,300)	(2,800)
Auto Capacity Deficiency***			
2001	NA	2,600	NA
2011	NA	4,200	NA

Central York Corridor Transit Capacity Implications

Year	Person Trips To Be Diverted To Transit	Total
2001	3,100	9,800 (34%)
2011	5,000	12,300 (39%)

* estimated based on TTS home to work travel volumes crossing screenlines and includes walk to transit, bus and commuter rail.

** Expected Transit ridership assuming no change in mode split.

*** With planned 2001 road improvements.

3. Development of Transit Options

3.1 Key Factors

As indicated in the previous section, projections of future travel demand within the study area suggest that major deficiencies in road capacity across the boundary between Metropolitan Toronto and the Region of York, are most likely to occur in the central section of this east-west screen line. This deficiency results from the strong orientation of travel within the central York-central Metro corridor throughout the entire length of Yonge Street. At the same time, other studies carried out by Metropolitan Toronto and the Toronto Transit Commission in support of the *Network 2011* concept, suggest major east-west transit demand within the broad area of Metro Toronto north of Highway 401.

In developing transportation alternatives for serving these anticipated demands as efficiently as possible, three basic objectives have been adopted. First, recognizing the practical limitations on expansion of the road system over and above those improvements that have already been approved, transit alternatives have been developed to maximize the likelihood of increased modal split for cross boundary travel between York Region and Metropolitan Toronto.

Second, given the likely limitations on available finance at both the provincial and municipal levels, one of the key objectives is to maximize the cost effectiveness with which limited financial resources can be used to achieve a variety of transportation and land use objectives. Improving the utilization of *existing* facilities and services, generally known as improved transportation system management, is an important element of cost effectiveness.

Third, although the range of potential transit improvements within the study area is extremely large, the transit alternatives developed have been restricted to those which are both consistent with and supportive of various objectives for the orderly growth of development within Metropolitan Toronto as well as within the Region of York. In this regard, Metroplan, the Official Plan for Metropolitan Toronto, is probably the most important development concept to be taken into account.

These objectives related to increased use of transit, cost effectiveness, and the achievement of land use goals, are the key factors leading to the development of four distinct transit options described in the remainder of this chapter.

3.2 Elements of the Transit Options

The basic elements of the transit options developed in the course of this study include improvements of two types. The first involve expansion of surface transit where capital investment is largely restricted to vehicle costs. For example, the recently completed *York Region Transit Study* recommended a system of surface transit routes, reproduced in Exhibit 3.1, which is tied to the growth in residential and employment development within the region. Although, at present, urban transit services within the Region of York are provided by five separate municipal transit organizations (in addition to GO Transit), this network of proposed future services assumes improved coordination and integration of services, either under a single transit authority or through some other mechanism.

The second element of the transit options involves major facilities where considerable investment may be required both for right-of-way acquisition and construction in addition to vehicle investment. This second category includes expansion of the TTC rapid transit system, additions to the GO Transit rail network, and major interchanges between roads and transit known as gateways. Some potential TTC and GO Transit rail improvements have already been noted briefly in Section 1.2. In addition, a number of transit gateways as well as transit priority lanes have also been suggested in the *York Region Transit Study* and in other studies carried out by the Ontario Ministry of Transportation. Some of these various initiatives are tabulated in Exhibit 3.2.

There is, of course, a strong relationship between these two basic elements of the transit options. Particularly in the Region of York, where the surface transit system is neither as well as integrated nor as well developed as the system within Metropolitan Toronto, there is a need to ensure that new capital investment in major transit facilities is supported by complementary improvements in the feeder and distribution surface services. For this reason the surface network proposed in the York Region study was designed to accommodate both intra-regional transit needs as well as cross boundary transit needs

Bus Routes Proposed in York Region Study

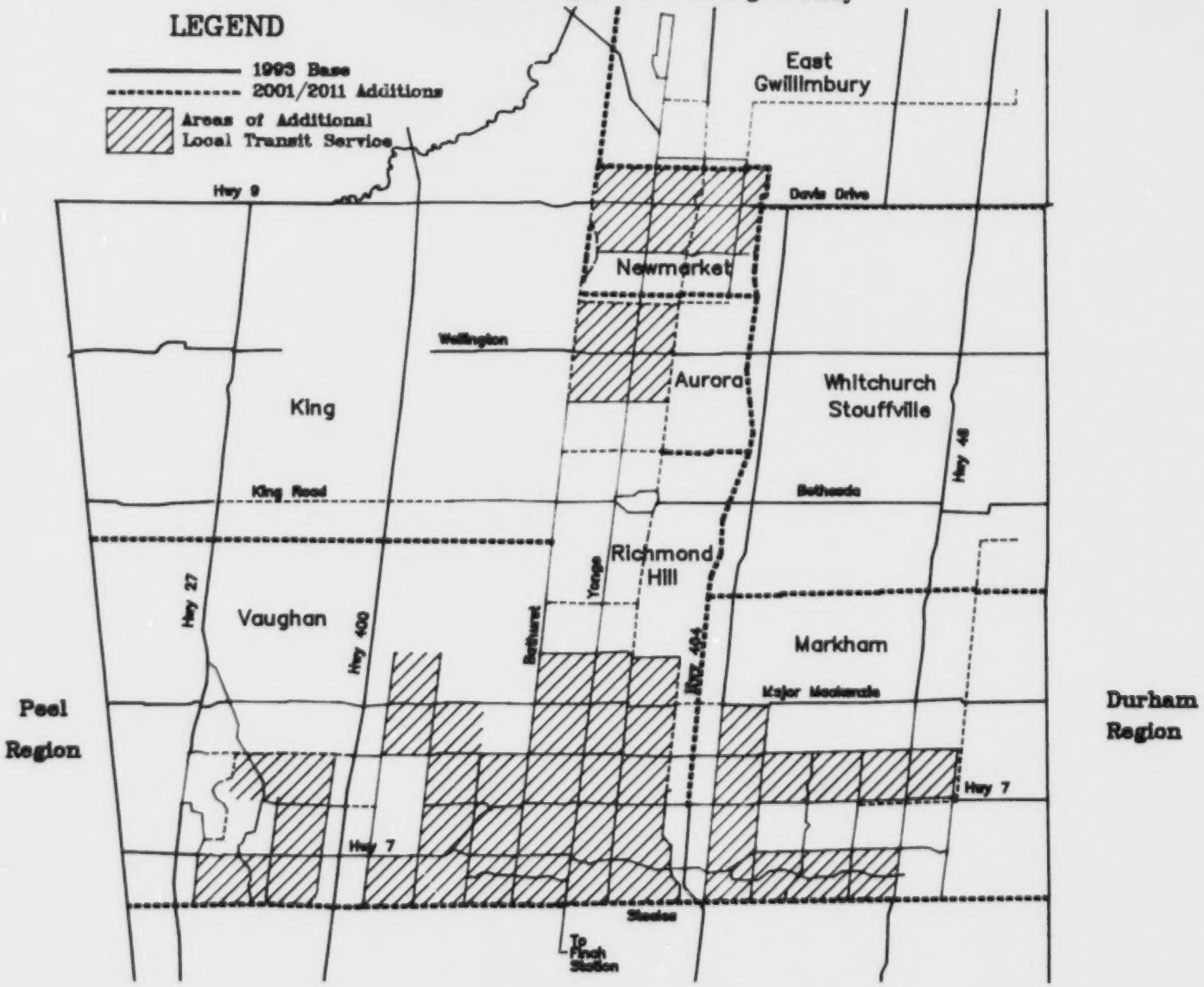


Exhibit 3.2

Summary of Major Initiatives Relevant to North Boundary Transit

Item	Comment
Rapid Transit	
Yonge Subway capacity expansion by increasing train frequency	recent studies undertaken by the TTC to achieve reduced headway through redesign of terminal facilities, selected stations (e.g.Bloor/Yonge), and signal modifications
Sheppard Subway	first stage from Yonge to the Scarborough City Centre as recommended in *Network 2011*, already approved by Metro
Spadina Subway extension	an extension from Wilson to Sheppard recently approved by Metro and the Ministry as the first stage of subway network expansion
Finch Hydro corridor exclusive transit lanes	once considered within the *Network 2011* studies as an alternative to the Sheppard Subway and recently recommended as a two-lane, at-grade, bus-only facility, in the *York Region Transit Study*
Scarborough RT extension to the Northeast	currently under study by the TTC and referenced in the 1988 *Transportation Directions for the GTA*; some controversy as to most appropriate technology
Commuter Rail	
Richmond Hill	expansion to full service, extension to Bloomington Road, and relocation of Metro stations to facilitate better TTC connections and provide GO operational advantages
Stouffville	increased peak period frequency and new stations to interchange with the Scarborough RT and Bloor-Danforth Subway
Bradford	increased peak period frequency and a possible new connection to the extended Spadina Subway

through better integration with regional services, improved connections to the TTC system within Metro, and a strong focus on new transit gateways.

Aside from assumed improvements in surface transit, in consultation with the Review Committee, four distinct transit network alternatives were developed during the course of this study as the basis for further analysis. One combination of facilities common to all options considered is referred to as the *Base Case*.

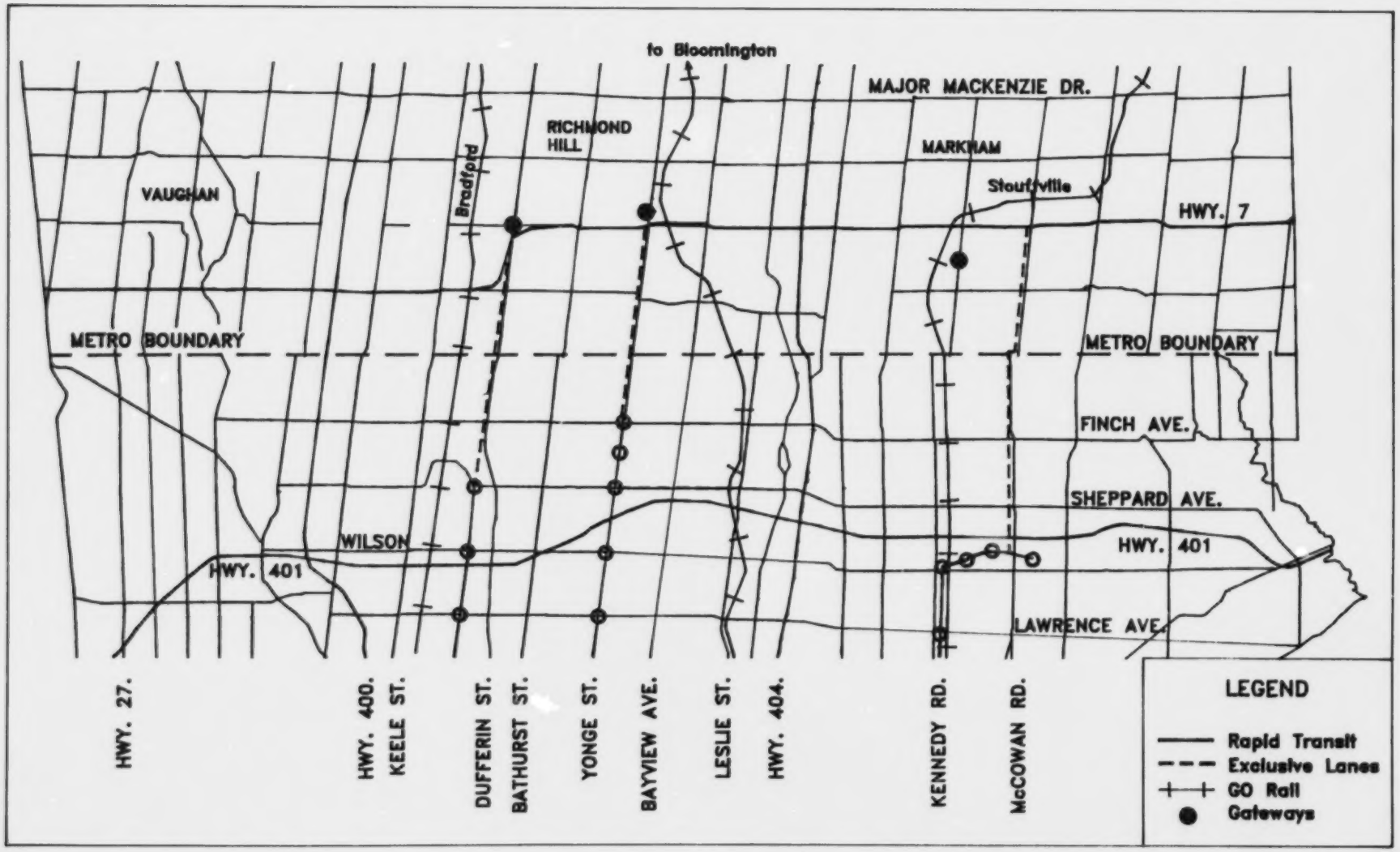
3.3 Base Case

The base case alternative shown in Exhibit 3.3 is defined to include a number of transit initiatives that are expected to be in place by 2011. These include existing commitments as well as projects within the study area on which there is already general consensus as to need on the part of various transportation agencies consulted during the course of the North Boundary Study.

The base case includes a number of road improvements, expansion of GO rail service on all three lines that now serve York Region, transit gateways, and exclusive transit or high occupancy vehicle (HOV) lanes on existing north-south arterials which cross the Metro boundary. The base case also includes extension of the Spadina Subway from the present terminal at Wilson Avenue to Sheppard Avenue, recently approved both by the Ministry and Metropolitan Toronto. No other expansion of the TTC rapid transit network is included in the base case.

Road improvements included in the base case involve a number of north-south widenings at the Metro boundary. As shown previously in Exhibit 2.14, the effects of the proposed widenings are considerable, increasing road capacity across the Metro boundary at Steeles Avenue by about 71% from 35,550 vehicles per hour, at present, to 60,900 in 2001.

Exhibit 3.3
BASE CASE



Expansion of the GO Rail system involves three distinct elements, namely:

increased frequency of service on all three routes,

new stations designed to provide better integration with the TTC at the Ellesmere and Eglinton stations of the Scarborough RT on the Stouffville service and at the Oriole and Cummer stations on the Richmond Hill service, and,

extension of the Richmond Hill service from its present terminal at Highway 7 andYonge Street to a new terminal in the vicinity of Bloomington Road.

Relocation of the Oriole and Cummer stations on the Richmond Hill service is predicated on a sufficient increase in train frequency to justify direct access by TTC bus services on Finch Avenue and Sheppard Avenue. The northerly extension of the Richmond Hill route is designed to attract greater ridership from Aurora and Newmarket as well as from rural communities to the north and east (through park and ride facilities). This extension also provides considerable operating advantages for GO Transit by reducing the amount of "dead heading" or empty running required in cycling trains.

The base case also includes regional transit gateways at Dufferin Street and Highway 7, at Langstaff (Yonge Street and Highway 7) on the Richmond Hill service, and at the Unionville GO Station on the Stouffville service. In addition, reserved transit lanes or HOV lanes are assumed on Dufferin Street, Yonge Street and McCowan Road between Highway 7 and the closest TTC subway or rapid transit stations to the south. Until such time as the Sheppard Avenue Subway is approved and implemented, exclusive transit lanes are also included on Sheppard Avenue between Yonge Street and Leslie Street, possibly involving grade separations at Bayview Avenue and Yonge Street.

Compared to 1989 capacity across the Metro-York boundary, the net effect of these improvements incorporated in the base case is to increase peak period capacity by 71%, 104%, and 420% for roads, surface transit, and commuter rail, respectively. The base case, therefore, represents a sizeable investment relative to the existing system of transportation that now serves the study area. Although cost estimates for these improvements have not been included this study, the transit improvements reflected in the base case assumptions probably total $500 to $600 million over the next 20 years and, as discussed in Chapter 4, they do make a significant impact on the deficiencies described earlier in Section 2.3.

3.4 Alternatives for Network Expansion

The base case described in the preceding section serves as a common starting point for consideration of a number of additional improvements to the transit system. The key factors summarized in Section 3.1 played an important role in defining the specifications for the various options developed, namely:

- an east-west rapid transit distributor within Metro, north of Hyw 401
- increased transit accessibility between the North York and Scarborough Centres and their respective employment markets
- improved transit accessibility for other, non-central employment development
- enhancements in the attractiveness of cross boundary transit services that lead to increased modal split
- financial affordability
- cost effectiveness relative to alternative uses of public funds for transit
- improvement in the utilization and efficiency of existing and committed facilities and services

Initially, a number of alternatives were developed in response to these specifications. The initial alternatives, however, were subsequently reduced to three distinct networks by the study Review Committee. As a result, a number of possible variations were excluded from further analysis which, with the benefit of hindsight, might meet the required specifications more effectively.

Each of the three alternatives selected for evaluation involve major additions to the base case rapid transit system. No additional road improvements have been considered over and above those included in the base case. All three options include additional exclusive transit lanes on Woodbine/Victoria Park Avenue that connect with the cross town facility included in each option.

The *Sheppard Emphasis* alternative, shown in Exhibit 3.4, essentially involves the base case supplemented by a Sheppard Avenue subway between the Spadina Subway and the Scarborough City Centre. From a functional standpoint, this alternative would enforce land use concepts for development of both the North York and Scarborough City Centres as well as other sites in the Sheppard corridor east of Yonge Street. It would also improve transit travel times and ease congestion on Sheppard Avenue, one of the most heavily used surface transit routes in Metro.

Depending upon the timing of this alternative, the exclusive transit lanes along Sheppard Avenue included in the base case would not be required. Alternatively, they would revert to normal traffic use once the Sheppard Subway becomes operational. The major segment of this subway between Yonge Street and the Scarborough City Centre, has already been approved as the first stage of the Sheppard Subway by the Council of Metropolitan Toronto. Although the segment west of Yonge Street to Dufferin Street was not included in the first stage, it is consistent with the already approved extension of the Spadina Subway to Sheppard.

A second alternative, referred to as the *Finch Loop*, is shown in Exhibit 3.5. In this option, the existing Finch terminal on the Yonge Subway would be connected to the Spadina Subway extension at Sheppard Avenue along an alignment in the general vicinity of the Finch Hydro corridor, subsequently turning south on Dufferin Street. This loop would include new stations at Finch and Dufferin as well as where the east-west section crosses Bathurst Street. This option also includes the construction of reserved bus lanes within the Finch Hydro corridor in two distinct segments, one, east of Yonge Street to McCowan Road, the other, west of Dufferin to the general vicinity of Highway 400. These segments of the busway would thus serve the Yonge-University-Spadina Subway *system* from both the east and west.

Functionally, this option is designed to improve surface transit access to the subway system for both TTC and cross boundary buses originating in the Region of York. It should also produce important subway operational benefits, notably with respect to eliminating constraints on Yonge Subway capacity due to terminal turnaround time, and encourage development of the North York City Centre.

Exhibit 3.4
SHEPPARD EMPHASIS

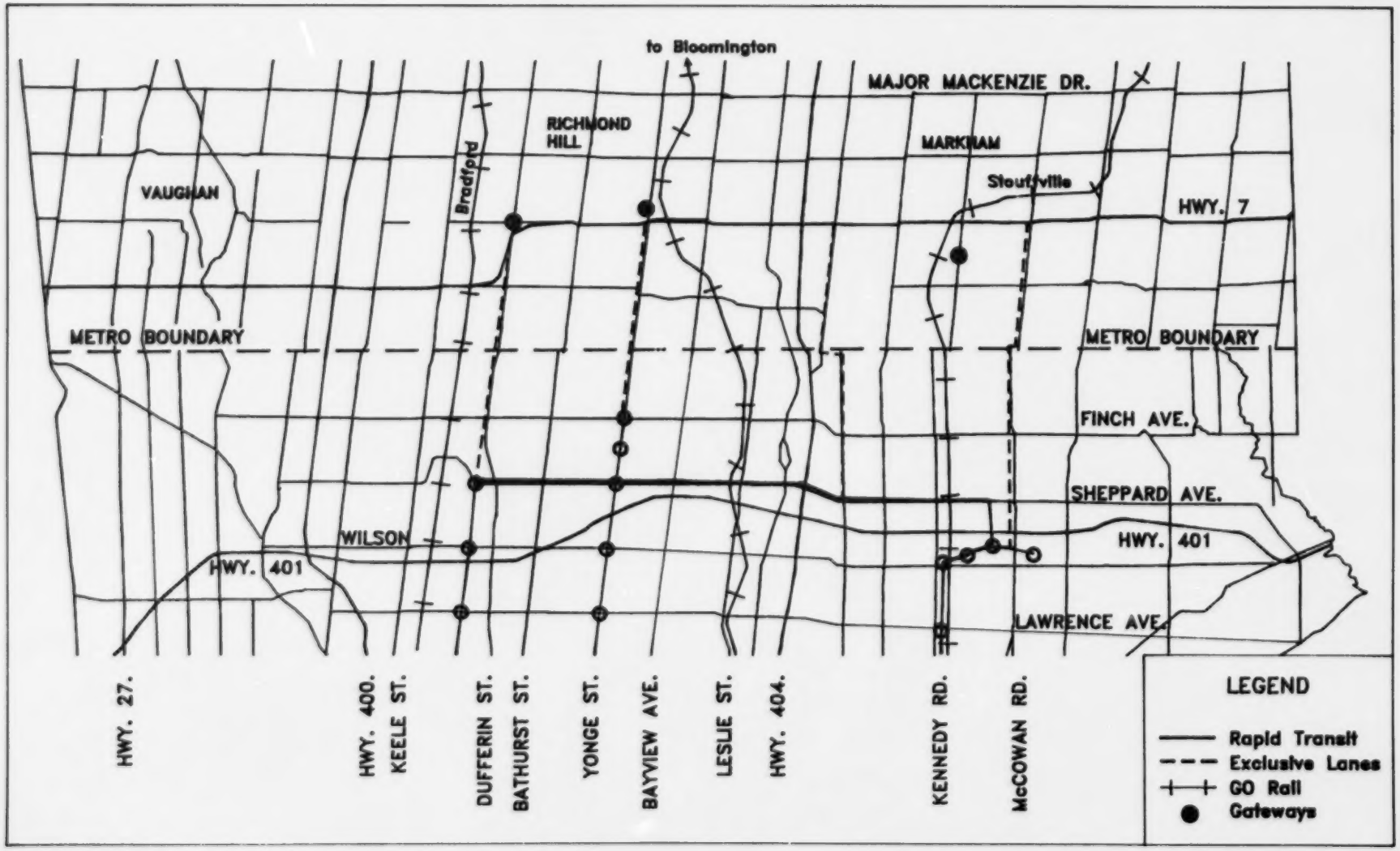
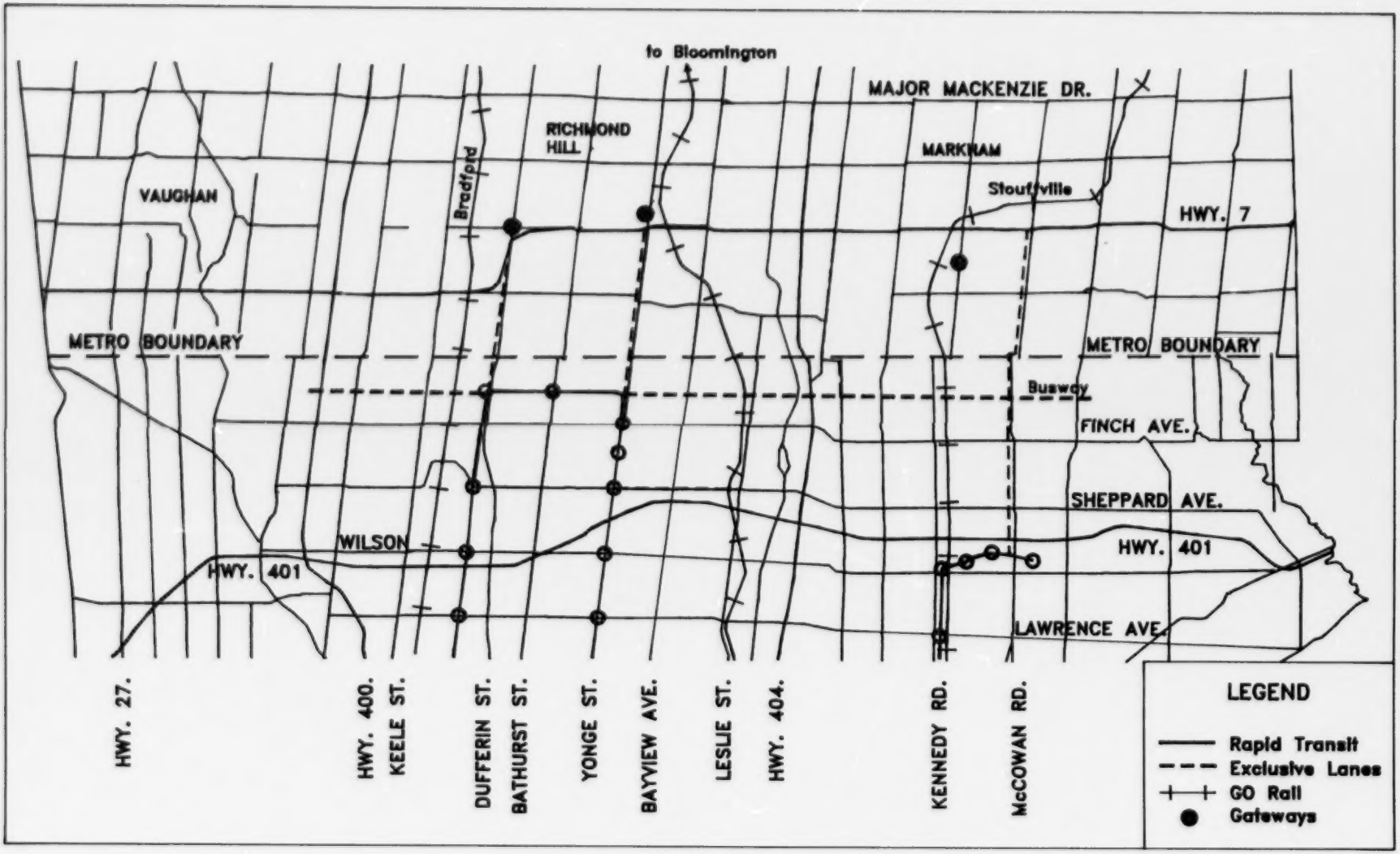


Exhibit 3.5
FINCH LOOP



From a functional standpoint, the precise location of the east-west component of the subway loop is not particularly important. More detailed route location studies, for example, would certainly examine an alignment along Finch Avenue, or possibly, even further north of the Hydro corridor. At this time, however, location within the Finch Hydro corridor has been assumed to both minimize construction costs and maximize ease of implementation.

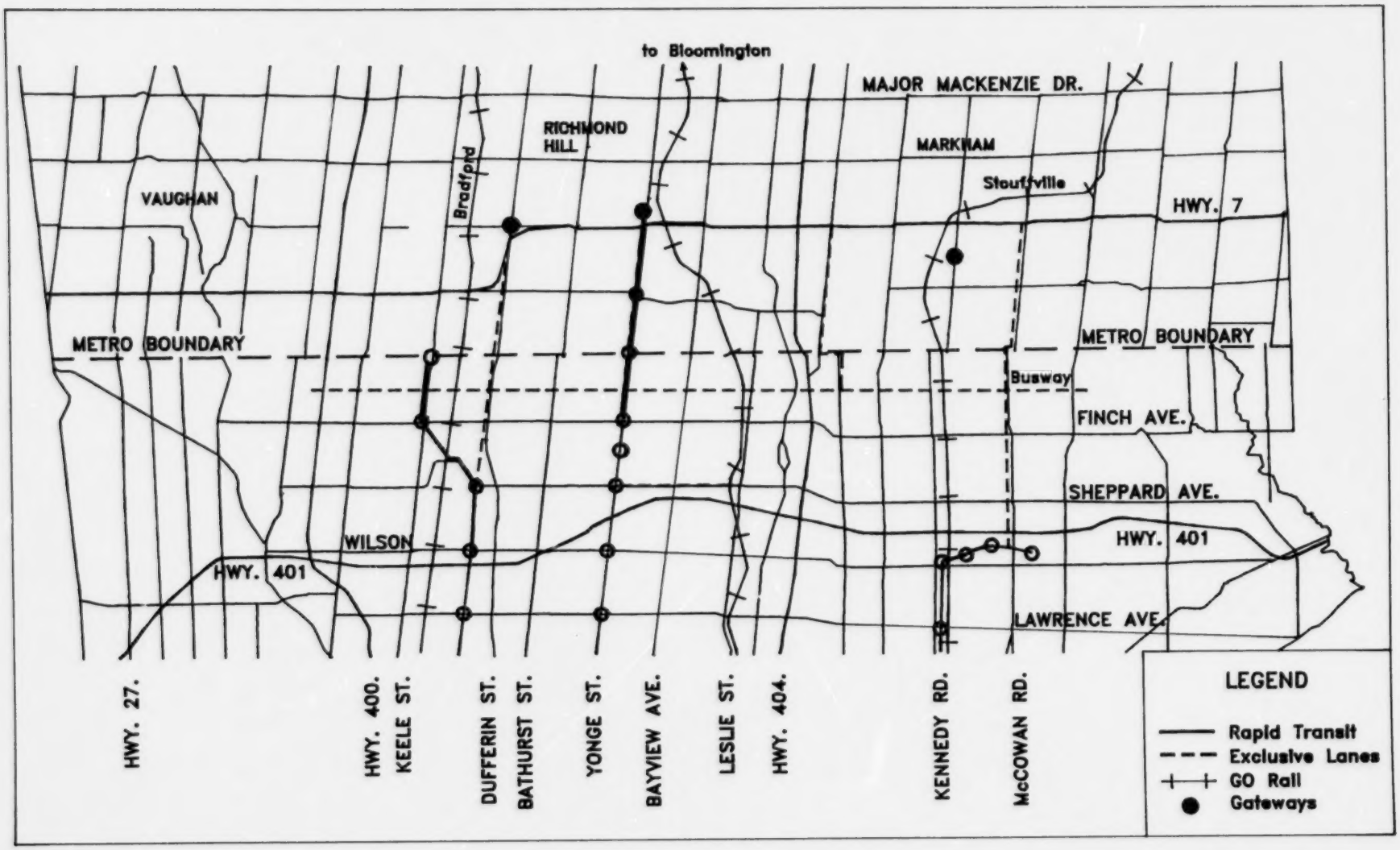
The final alternative considered, shown in Exhibit 3.6, is referred to as the *Radial Network*. In this option, the Yonge Subway is extended into York Region as far as Langstaff and the Spadina Subway is extended to the general vicinity of York University (Keele Street and Steeles Avenue). The east-west busway within the Finch Hydro corridor between Highway 400 and McCowan Road is also maintained including, in this case, the segment between Dufferin Street and Yonge Street. As in the case of all alternatives with a major east-west facility, additional exclusive transit lanes are also provided on Victoria Park Avenue. The primary task of this radial option is to provide more direct rapid transit access for cross boundary travel from York Region by reducing the need for bus-subway transfers. The radial option also improves opportunities for reverse flows, particularly in the case of York University. In addition, because the largest *increase* in work trips to the North York City Centre is expected to come from the southern area of central York Region, the Yonge Subway extension would support development objectives for that development.

3.5 Summary

The various combinations of improvements associated with each of the networks described in this Section reflect existing proposals, responses developed to deal with particular problems identified in the demand analysis, and suggestions proposed during the course of the study by representatives of various planning and operating agencies. Eventually, the four alternatives described were agreed upon by the Review Committee as the basis for further evaluation. Compared to the Base Case, all three alternative networks include a major east-west transit facility, some subway expansion, and additional north-south exclusive transit lanes that tie into the east-west facility. As noted previously, a number of possible variations of these alternatives, particularly in the case of the Finch Loop and Radial Network, were excluded from further consideration at this time.

Exhibit 3.6

RADIAL NETWORK



4. Comparative Evaluation

4.1 Evaluative Measures

Measures used in the comparative evaluation of the transit alternatives described in the preceding chapter, basically concern the extent to which each alternative is likely to increase the transit share of cross boundary travel, cost effectiveness and financial affordability, and the compatibility of each alternative with land use planning objectives. Specific performance measures relate to cost, travel impacts, implications for transit operations, and land use impacts.

The most important *cost measures* clearly relate to the capital cost of construction for new facilities and the investment required for the acquisition of rail rolling stock and buses. Some estimate of annual operating and maintenance costs is also useful for purposes of comparative cost evaluation. Relevant *travel impacts* include increases in cross boundary transit trips, system wide changes in modal split, and travel time savings, particularly as they affect the relative accessibility of specific development nodes.

From the standpoint of *transit operations*, key impacts relate to the TTC system and are concerned primarily with the effects of the alternatives under consideration on the capacity and efficient utilization of the entire Yonge-University-Spadina Subway system. Congestion and overcrowding on the Yonge Subway are already well known problems requiring attention, particularly given the dominant function which this facility plays within the entire Metro transit system. At the same time, in relative terms, the Spadina Subway is less congested and does offer some surplus capacity.

Land use impacts basically relate to the extent to which the transit alternatives are both consistent with and supportive of official plans and site specific proposals or opportunities that are in keeping with development objectives.

Clearly, there will be tradeoffs among these various impacts inasmuch as some alternatives may be more favourable from the standpoint of costs but less attractive from the standpoint of other measures of performance such as land use impacts. For this reason, the basic approach in this comparative evaluation relies on assessing the cost effectiveness

with which each alternative achieves an acceptable balance of modal split, operational, and land use objectives, from a variety of perspectives.[1] Because the base case represents some degree of consensus as to the extent of transit improvements that will be in place by 2011, most of these performance measures are defined relative to the base case.

4.2 Performance of the Base Case

As noted previously, the base case alternative represents a substantial increase in road capacity across the Metro-York boundary as well as even greater increases in the capacity of various cross boundary transit services. Between 1989 and 2001, for example, road improvements included in the base case increase peak period capacity by about 71% from a current value of 35,500 vehicles per hour to 61,000 vehicles per hour in 2001. As shown in Exhibit 4.1, compared to 1989 capacities, the increase in surface transit capacity during the peak period rises by 104% from 14,200 passengers to 29,100 passengers by 2011 whereas GO rail capacity offered increases by 420% from 4,100 passengers to 21,000 passengers.

These base case transit improvements rely almost entirely on GO rail expansion, supplemented by appropriate local feeder services and parking to serve the long distance downtown Toronto destinations. The effects of these increases in capacity on transit travel are summarized in Exhibit 4.2. As shown, most of the cross boundary transit potential would be served by the base case. The general level of service for all cross boundary travel to other destinations is also improved by the network of exclusive transit lanes on north-south arterials. In this regard, however, the "sunk cost" of the already committed Spadina Subway extension to Sheppard Avenue produces few travel benefits of any consequence.

In the case of transit operations, the base case improvements have no impact on Yonge Subway capacity since turnaround delays at the Finch terminal are not affected by

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[1] Clearly, the perspective is important. From the standpoint of Metropolitan Toronto, for example, the previous Council has already indicated the Sheppard Subway to be the preferred solution for achieving *its* land use objectives. In the evaluation of this study, as noted previously, a broader, regional perspective has been adopted which, hopefully, is also sufficiently sensitive to various local perspectives.

Exhibit 4.1

Comparison of North Metro Boundary Present and Base Case Transit Capacity

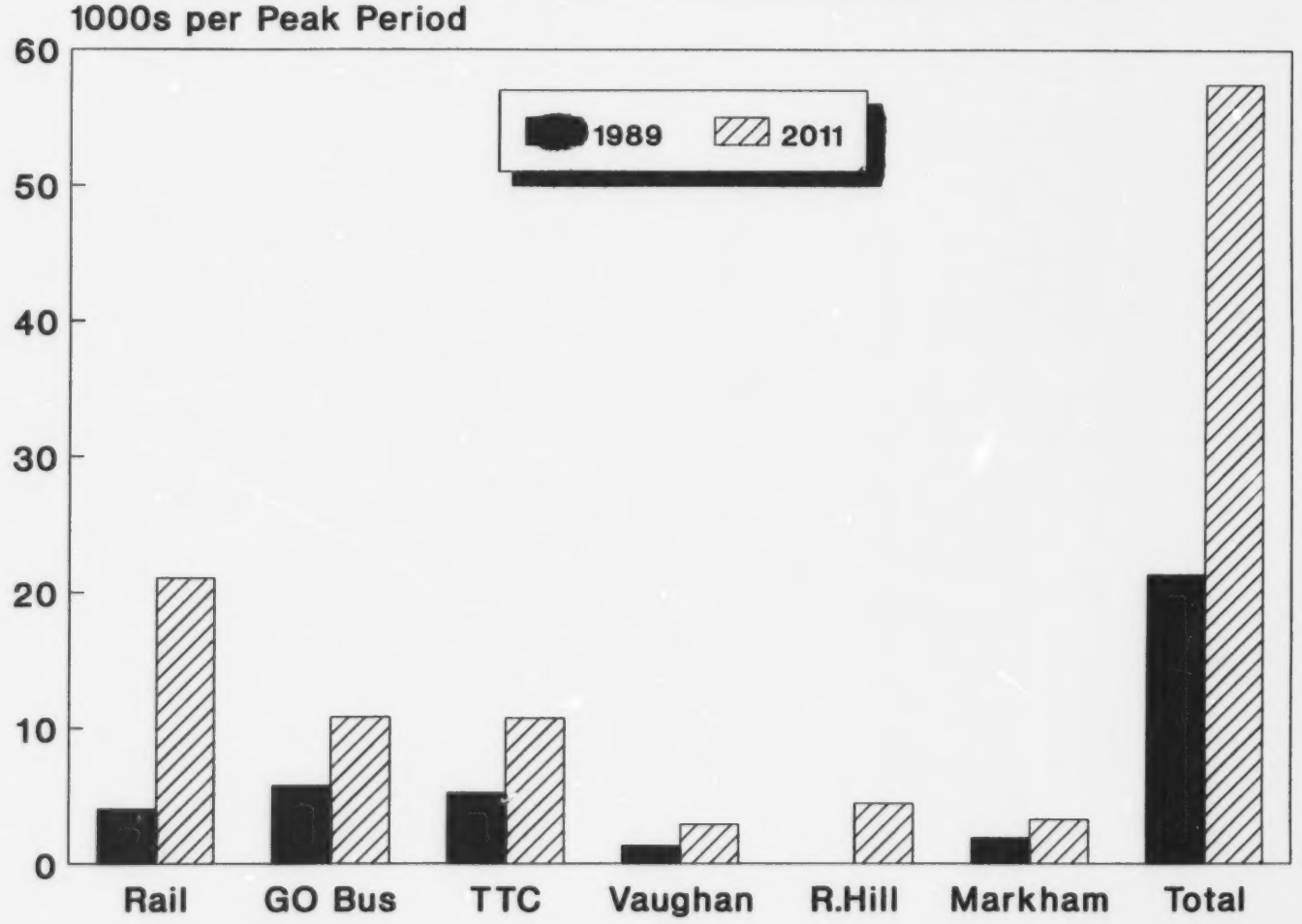


Exhibit 4.2

Estimated Base Case Transit Impacts

Cross Boundary Markets	Potential	GO Rail	Bus	Total	Residual
West	2,000	600	1,300	1,900	100
Central	14,000	3,900	8,100	12,000	2,000
East	5,100	1,400	1,700	3,100	2,000
Totals	21,100	5,900	11,100	17,000	4,100

the base case improvements. (Extension of the Spadina subway to Sheppard, however, does provide an opportunity to eliminate similar delays associated with the existing Wilson terminal.) Except for the modest impact of the Dufferin Street exclusive transit lanes, the base case is also likely to have little effect on redistribution of passengers from the Yonge Subway to the Spadina Subway. However, as the frequency of commuter rail service is increased, particularly in the case of the Richmond Hill service, operational benefits should also be realized on the Yonge Subway as a result of off-loading some longer distance trips. In addition, new stations connecting the Bloor-Danforth Subway with the Stouffville rail service (at Kennedy and Eglinton and/or Ellesmere) should also divert some traffic from the Yonge Subway.

With respect to land use impacts, accessibility to the Scarborough City Centre for York Region employment markets is improved significantly by upgrading of the Stouffville GO rail service in combination with the new stations at Ellesmere and Eglinton Avenues. Other than the travel time savings associated with exclusive transit lines on Yonge north of the present subway terminal at Finch Avenue, however, accessibility of the North York City Centre with respect to York Region employment markets is only marginally improved.

In the following sections, the performance of the Sheppard Emphasis, Finch Loop, and Radial Network alternatives is compared to the performance of the Base Case in relative terms.

4.3 Cost Comparisons

Cost comparisons for the three alternatives are summarized in Exhibit 4.3. The capital cost estimates basically represent "planning costs" as opposed to more precise cost estimates that would be available as a result of detailed design. Nevertheless, the relativity of costs is what is important at this stage. Relative costs have been determined in the following manner.

First, extensive work has already been carried out by the TTC over several years related to construction of the Sheppard Subway. Unit costs of construction were obtained

Exhibit 4.3

Transit Alternative Cost Comparisons[1]

Item	Sheppard	Loop	Radial
New Construction (Km)			
Subway	20.8	6.5	12.3
Busway	n/a	18.3	22.8
Total Rapid Transit	20.8	24.8	35.1
CAPITAL COSTS ($M)			
Construction			
Subway	1095	190	382
Contingencies & EPCM	575	100	200
Sub Total	1670	290	582
Busway	n/a	99	121
Contingencies & EPCM	n/a	52	64
Sub Total		150	185
TOTAL	1,670	440	767
2011 VEHICLE COSTS			
Subway Cars	194	61	115
Busway Vehicles	0	15	19
TTC Bus Savings	(42)	(35)	(11)
Sub Total	152	41	123
TOTAL INVESTMENT	**1,822**	**481**	**890**
2011 OPERATING COSTS $(M)			
Subway	29	9	17
Busway Vehicles	n/a	9	11
TTC Bus Savings	(26)	(20)	(6)
TOTAL	3	(2)	22
TOTAL 2011 ANNUAL COSTS			
@ 8%	156	38	97
@ 10%	189	45	111
@ 12%	224	56	130

[1] Notes:
Savings in bus capital and operating costs derived from Technical Paper No. 6 of the *Network 2011* studies, inflated at 5% per annum. Subway operating costs obtained from the *Sheppard/Finch Corridor Study* and similarly inflated. Annual cost calculations are based on service lives of 40, 30, and 17 years for construction, subway cars, and buses, respectively.

from previous studies and escalated to reflect the inflationary increases which are estimated to have occurred since the time of the original estimates.

Second, a preliminary appraisal of the type of construction most likely to be associated with the subway component of the Finch Loop and Radial Network alternatives was carried out. Escalated unit cost factors obtained from the analysis of the Sheppard subway were then modified, where appropriate, and applied to these two alternatives to arrive at capital cost estimates for the relevant subway components. Additional detail, prepared with the assistance of Hatch Associates, is included in Appendix A.

It should be noted that the estimate of average construction costs per kilometre implied in Exhibit 4.3, for the both the Finch Loop and the Radial Network, are considerably lower than for the Sheppard Subway. This occurs because of the generally easier construction environment, particularly in the case of the open cut section of the Finch Loop within the Hydro corridor.

Third, preliminary cost estimates for the reserved bus lanes in the Finch Hydro corridor were obtained from separate studies presently being carried out to examine the feasibility of that project in more detail. A breakdown of these cost estimates is also included in Appendix A.

As is usual in the case of preliminary cost estimates for a major capital facilities, some allowance must be made for engineering, procurement, and construction management (EPCM) as well as uncertainties or contingencies. In the case of subway construction in the Toronto area, these elements of costs are generally reflected in an adjustment factor of about 52.5%. The same allowance has been applied to the basic cost estimates for the Finch busway, even though surface construction of pavement clearly involves much less uncertainty than the heavy construction of a rail rapid transit system with all the usual fixed plant components such as track, switches, electrification and train control equipment. Engineering and procurement costs will also obviously be less.

Capital cost estimates for vehicles are shown in Exhibit 4.3 for both subway cars and buses. Here, allowance is made for a reduction in the total size of the TTC bus fleet that will result from the substitution of rapid transit for existing bus services. Associated reductions in vehicle operating and maintenance costs are also shown for 2011.

In general, the impacts of new rapid transit facilities on vehicle fleet requirements and operating costs have been derived from data and information available from various working papers produced during the *Network 2011* transportation studies carried out by the TTC and the Metropolitan Toronto Planning Department.

One additional factor that is not reflected in the cost comparisons of Exhibit 4.3 relates to the question of terminal costs associated with the base case. With no expansion of the rapid transit system, some flexibility for future expansion is likely to be included in the new terminal at Spadina and Sheppard (possibly to allow for the eventual construction of the Sheppard Subway). In the case of the existing Finch terminal on the Yonge Subway, the TTC is already designing modifications that will reduce turnaround delays and thus permit higher train frequency. These base case costs, which might be of the order of $30 to $40 million, could be reduced significantly in the case of both the Finch Loop and Radial Network options.

4.4 Travel Impacts

As noted in Section 4.2, transit improvements included in the base case are expected to handle a very large component of the 2011 road deficiencies across the Metro-York boundary. In addition to the impact of these improvements on modal split, commuter rail improvements, particularly on the Richmond Hill and Stouffville services, should also divert significant traffic from the Yonge Subway. These diversions would result from increased frequency of service on both routes as well as from a new connection between the Stouffville route between the Bloor-Danforth Subway at Kennedy Road. Exhibit 4.2 summarizes the ridership impacts of the base case for the three cross boundary markets discussed previously in Chapter 2. These figures suggest that the base case would capture

about 17,000 peak period trips of the total "potential" transit trips in 2011, leaving a residual of approximately 4,000 trips.

On the basis of the travel demand analysis carried out in this study, Exhibit 4.4 shows the impact of the alternative transit options with respect to additional cross boundary transit ridership. As indicated, the incremental effects of all three alternatives is relatively small in relation to the base case ridership. As expected, the Sheppard Emphasis option has very little impact on cross boundary ridership (an additional 600 passengers) largely because it is too far south to divert passengers desiring the shortest travel time to the Yonge Subway. By contrast, the Finch Loop and Radial Network increase peak transit ridership for cross boundary travel by about 2,000 passengers each, or more than ten percent of the ridership achieved by the base case.

Exhibit 4.4 also provides preliminary estimates of peak hour volumes on various rapid transit and bus services associated with all four alternatives. In addition, the forecasting method was used to estimate the number of peak hour passengers that would be diverted from the Yonge Subway to the Spadina Subway, an effect which is considered to be important from the standpoint of operational impact, given current perceptions about overcrowding on this facility.

Finally, Exhibit 4.5 shows the estimated impact of all four options on door-to-door travel times for selected origins. Overall, none of the expanded systems generate significant travel time savings relative to the base case improvements. Even differences in travel times among the expansion alternatives are also small. As a result, the key benefits associated with any of these alternatives (relative to the base case) certainly appear to relate more to land use impacts and the impact on quality of service for the remainder of the TTC system (such as reduced crowding on the Yonge Subway) than to increases in modal split.

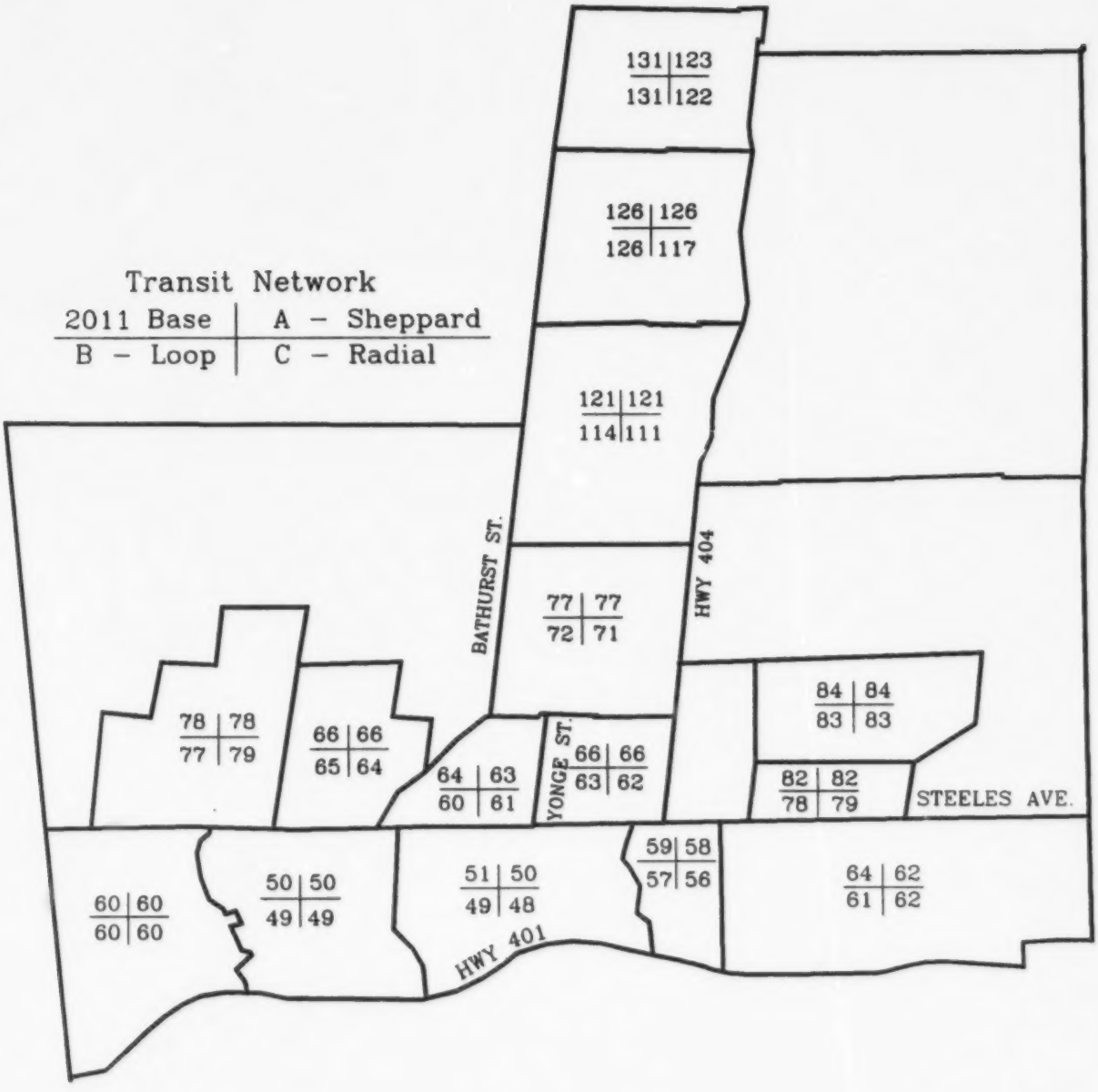
Exhibit 4.4

Comparison of Peak Hour Transit Impacts of Alternatives

Item	Base Case	Volume Increment Sheppard	Loop	Radial
Cross Boundary Markets				
West	1,900			100
Central	12,000	200	1,500	1,500
East	3,100	400	500	500
Sub Total	17,000	600	2,000	2,100
Peak Volumes				
Sheppard Subway	n/a	10,000	n/a	n/a
Finch Busway	n/a	n/a	7,000	7,000
Selected Peak Bus Volumes:				
Sheppard Ave.	3,200	1,300	3,200	3,200
Finch Ave.	4,200	3,000	2,000	2,000
North Yonge	4,200	3,500	4,000	1,000
Dufferin St.	700	1,000	1,000	700
Bathurst St	2,100	2,200	2,500	1,900
Diversions from Yonge to Spadina Subway	--	--	2,000	--

Exhibit 4.5

Comparative Transit Trip Times* For Selected Origin Districts



*Average Total Door-to-Door travel times in minutes, including access and transfer penalties, based on MADITUC Assignments of 1986 TTS transit trips to four 2011 Networks.

4.5 TTC System Operational Impacts

One of the key determinants of Yonge Subway capacity concerns possible train frequency. Transit expansion that permits, in some way, an increase train frequency would thus provide significant operational benefits to the TTC. In addition, transit alternatives that result in the redistribution of ridership from the Yonge Subway to the Spadina Subway would also have beneficial impacts.

With respect to possible increases in train frequency on the Yonge Subway , it should be noted that the most critical limiting factor, at this time, relates to turnaround operations at the existing Wilson and Finch terminals, both of which now limit maximum frequency of service to about 28 trains per hour. The August 1988 TTC study, *Yonge-University-Spadina Improved Headway Study*, shows that by reducing these turnaround delays, a modest increase in train frequency can be achieved before other factors, such as station dwell times at Bloor and Yonge, become the key determinants of capacity.[1]

Extension of the Spadina Subway to Sheppard allows the TTC sufficient design flexibility to eliminate the restrictions imposed by the Spadina portion of the Yonge-University-Spadina Subway. As noted previously, the TTC is presently designing fairly costly, design modifications to the Finch terminal to achieve similar advantages. However, as stated in the TTC report,

> Headway reduction ... is limited by the turnback operation at Wilson and Finch stations. The required turnback time can be achieved by modifying and extending the tail track structures. An alternative to terminal station reconfiguration would involve extending the Yonge Subway to Steeles.

In this respect, therefore, both the Finch Loop and Radial Network options achieved the same purpose in slightly different ways. In the Finch Loop alternative, continuous operation is possible because the circular nature of the Yonge-University-Spadina operation will no longer require all trains to be turned back at the present terminals. Under the

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[1] The TTC report noted summarizes the findings of a number of individual studies that examined various aspects of increasing Yonge Subway capacity. One of these studies completed in February, 1988 by Transmode Consultants Inc., *Opportunities for Incremental Increases in Yonge Subway Frequency*, specifically treats turnaround at the Finch terminal.

Radial Network option, extension of both the Spadina and Yonge subways permits new terminal designs that would also reduce turnaround restrictions. In either option, capacity of the Yonge Subway could be increased by some two to three trains per hour, representing a capacity increase of approximately 10%. A 10% increase in subway capacity is approximately the same order of magnitude as the total volume of passengers carried during one hour on any of the commuter rail improvements assumed in the base case.

The second operational dimension noted above relates to diversions of ridership between the Yonge and Spadina Subways. As indicated in Exhibit in 4.4, such diversions are estimated to be significant only in the case of the Finch Loop alternative. This occurs largely because under the loop concept, there are essentially three major access points in the Yonge-University-Spadina Subway system (Dufferin, Bathurst and Yonge). Some passengers who would join the present system at the Finch terminal would find it advantageous from the standpoint of travel time and/or comfort to use the Spadina and Yonge segments of the subway system.

4.6 Land Use Impacts

Land use impacts are among the least quantifiable consequences associated with particular transit improvements or networks. Although the strong relationship between land use and accessibility has long been recognized in the field of urban planning, the ability to estimate land use effects associated with particular transportation improvements is still largely a qualitative process. Clearly, improved accessibility is a necessary (though not sufficient) condition to promote development objectives, and one which enhances development opportunities where other important factors related to markets and appropriate zoning are also present.

As noted several times in this report, the key development objectives within Metropolitan Toronto that are likely to be affected by transportation improvements considered in this study relate to the concept of regional subcentres, notably, the North York City Centre and the Scarborough City Centre. Other opportunities for employment concentration that relieve some of the pressures on the traditional downtown within

Metropolitan Toronto are also consistent with Metro's official plan. In this regard, it is generally accepted within Metropolitan Toronto that the Sheppard Subway has, in fact, been proposed largely to enforce development objectives for the two city centres in North York and Scarborough, as well as other development potential along the Sheppard corridor.

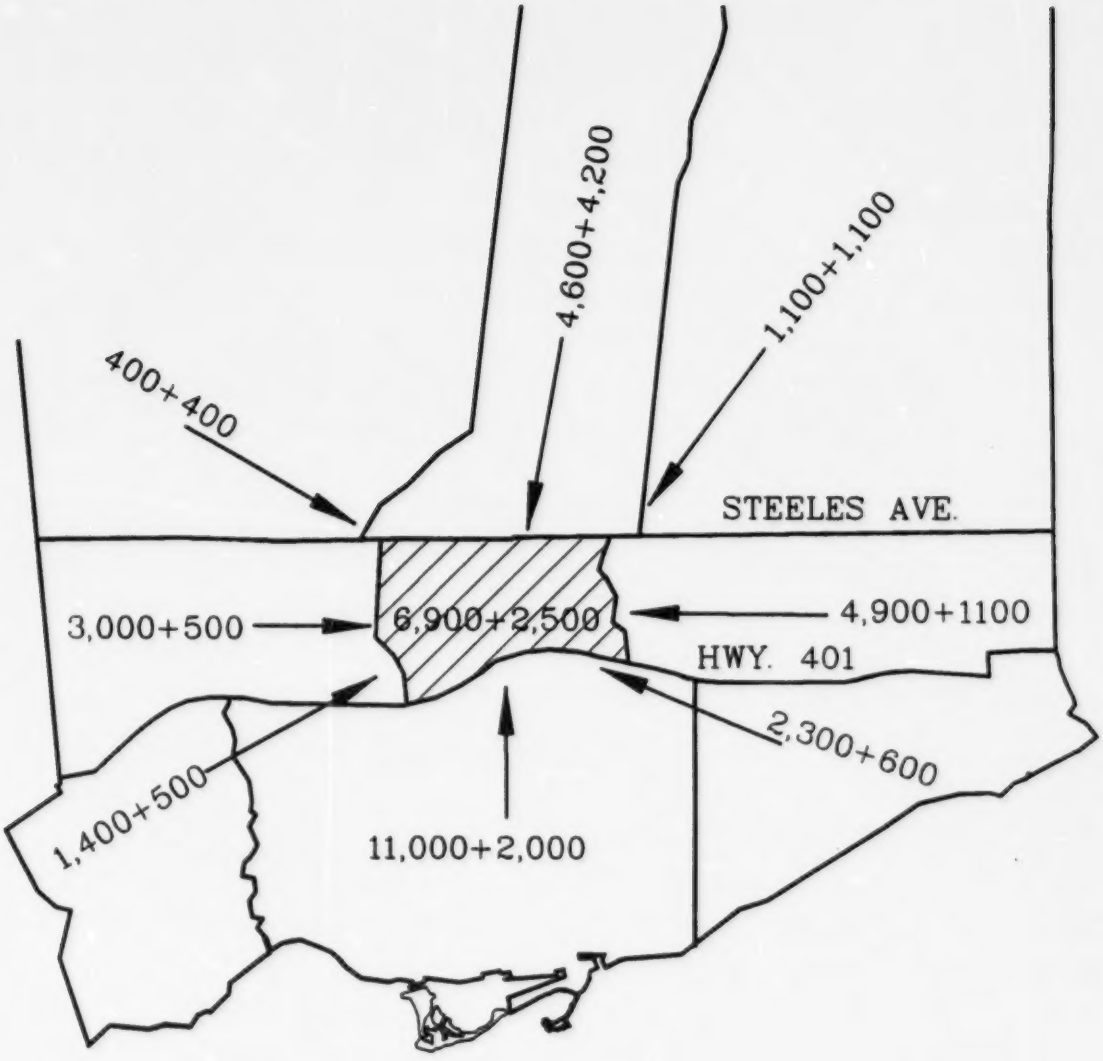
Improved accessibility, as would be provided to the North York City Centre by construction of the Sheppard Subway, also has a second dimension, namely, one that is related to the orientation of new transportation facilities with respect to travel demand or the origins of new employment destined to a particular development node. In other words, the different transit alternatives considered in this study affect the relative accessibility of different traffic zones.

Exhibit 4.6 compares 1986 work trips (obtained from the *Transportation Tomorrow Survey*) from various areas to Planning District 11, which includes the North York City Centre. For example, in 1986, 11,000 work trips to Planning District 11 originated in central Metro, south of Highway 401, compared to 4,900 in East Metro, north of Highway 401, and 4,600 from central York Region. The estimated growth in work trips by 2011 is also shown. This exhibit basically shows that, by far, the largest increase (4,200) in work trips to Planning District 11 originate from areas to the north. Because the greatest potential for growth in new work trips to the North York Centre exists in the central section of York Region, this growth in travel would be best served by the Yonge Subway component of the Radial Network which accesses all three stations without the need to transfer.

These results are not particularly surprising inasmuch as the North York City Centre is, in fact, a continuum of development along Yonge Street between Sheppard Avenue and Finch Avenue that is already served by three subway stations, namely, Sheppard Station, Finch Station, and the recently opened North York City Centre Station. Depending upon the ultimate destination of work trips within this continuum of development, both the Sheppard Emphasis and the Finch Loop would involve transfers whereas, as noted above, the Radial Network would not. In general terms, the Finch Loop provides better overall

Exhibit 4.6

Present and Future Work Travel to
North York City Centre
(1986 TTS + 2011 Growth)



transit access to the North York City Centre from the west, north, and northeast, whereas the Sheppard Emphasis option provides better transit accessibility from the southeast.

The Sheppard Subway, of course, improves accessibility for other development nodes within the Sheppard corridor at such locations as Consumers Road and possibly Kennedy Road, as well as for the MacLean Hunter site east of Yonge Street between Highway 401 and Sheppard Avenue. On the other hand, the Finch Loop and associated Hydro corridor busway should support development of the North York City Centre at Finch and Yonge, and new development at Finch and Keele (the tank farms) and in the general vicinity of York University. Aside from direct support of the North York City Centre, the Yonge Subway extension of the Radial Network would encourage development at the Langstaff gateway thereby contributing, to some extent, to objectives for decentralization.

In the case of the Scarborough City Centre, transit alternatives other than the Sheppard Emphasis, provide few, if any, land use benefits. There is, however, a reasonably strong travel orientation between the eastern areas of York Region and the Scarborough City Centre where transit accessibility would be greatly enhanced through improvements to the Stouffville commuter rail service, including a new transfer point at the Ellesmere station of the Scarborough RT.

4.7 Summary Comparison

Exhibit 4.7 summarizes some of the more important impacts associated with the various transit options relative to the base case. The remaining transit alternatives are ordered in this exhibit according to increasing capital investment, as a means of comparing the benefits obtained for the incremental investment required. In other words, a cost effectiveness approach is used.

As opposed to traditional benefit-cost analysis in which some quantitative measure of benefits (such as operating cost and travel time savings) are compared to some measure of project cost (such as annual costs or present discounted value), cost effectiveness is basically concerned with examining explicit benefits with respect to a more diverse set of

Exhibit 4.7

Summary Evaluation Relative to the Base Case

Item	Loop	Radial	Sheppard
INCREMENTAL INVESTMENT ($Millions)			
Relative to:			
Base Case	481	890	1,822
Finch Loop		409	1,341
Radial Network			932
2011 INCREMENTAL ANNUAL COST @ 10% ($Millions)			
Relative to:			
Base Case	45	111	189
Finch Loop		66	144
Radial Network			78
Cross Boundary			
Incremental Peak Volume	2,000	2,100	600
Yonge Subway Peak Hour			
Increased Capacity	3,000	3,000	
Diversions to Spadina	2,000		
Land Use Benefits			
North York	High	High	High
Scarborough	Low	Low	High
Langstaff Gateway	Low	High	Low
Other			
Sheppard Corridor	Low	Low	High
McLean Hunter	Medium	High	High
Finch and Yonge	High	High	Medium
Tank Farms	Medium	High	Low
York University	High	High	Low

objectives. Cost effectiveness permits a more distinct evaluation of the tradeoffs involved in moving from one level of expenditure to another.

For example, moving from the Radial Network to the Sheppard Emphasis alternative involves an incremental capital investment of $932 million.[1] For this incremental investment, greater land use benefits are obtained with respect to development of the Scarborough City Centre. Examining this differential impact alone, within the context of cost effectiveness, raises two basic questions. One, is whether the additional land use benefits involved justify the sizeable expenditure. The second is whether even greater land use benefits could be achieved by investing an equivalent amount, or less, in some other project, such as an extension of the Scarborough RT. There is, of course, always a third question that relates to whether this incremental investment can be used more effectively for other transit purposes that fall outside the scope of the present cost effectiveness analysis, such as the Mississauga Busway/Eglinton Rapid Transit project or other projects identified in *Transportation Directions for the Greater Toronto Area.*

This simplified explanation of cost effectiveness clearly becomes more complex when a variety of performance measures are affected by the incremental investment. However, in examining the specific results shown in Exhibit 4.7, at least from the standpoint of the impacts selected and the assessments made in the preceding sections, the cost effectiveness evaluation is fairly straightforward.

In fact, moving sequentially to the higher cost alternatives, produces no additional benefit with respect to incremental cross boundary transit volumes or operational benefits

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[1] Opportunities for reducing the *public* cost of the Sheppard Subway emerged in November, 1989 with a private sector proposal to finance a portion of the total construction cost of the segment between Yonge Street and Victoria Park Avenue. This proposal involves a mix of direct contribution and long term financing. However, no allowance has been made in the comparative evaluation of alternatives for this potential reduction in the public costs of the Sheppard Emphasis alternative. Presumably, similar arrangements would also be possible for financing other transit projects under consideration, should this method of financing be attractive from the standpoint of the public interest.

related to the Yonge-University-Spadina Subway system. The major difference in the performance among the alternatives considered relates almost entirely to differential land use impacts. Here, as already noted, the greatest difference occurs in the case of the Scarborough City Centre as well as other potential development nodes within the Sheppard corridor. On this basis, the Finch Loop option outperforms the other alternatives for system expansion from the standpoint of cost effectiveness, particularly in view of the large magnitude of the incremental investments involved.

Obviously, the assessment of land use benefits involves more qualitative than quantitative judgement. In approving the Sheppard Subway, for example, Metropolitan Toronto has already indicated the view that this facility would be the most effective way of supporting development of the North York City Centre. However, the travel impact analysis of this study suggests that an east-west transit distributor further north, is equally supportive of the continuum of development between the Sheppard and Finch stations of the Yonge Subway, including the North York City Centre station.

For an investment of $481 million above the investment required for the Base Case, the Finch Loop offers a number of advantages. This option:

- permits a 10% increase in Yonge Subway capacity
- facilitates better integration of cross boundary transit services
- increases cross boundary transit ridership by about 10% compared to the Base Case
- improves access to the Yonge-University-Spadina Subway and diverts about 2000 passengers from Yonge to Spadina during the peak hour
- provides crosstown rapid transit that is consistent with the overall direction of Metroplan
- supports the North York Centre
- supports development potential of the Tank Farms and Downsview
- improves access to York University and takes advantage of reverse flow potential

- does not preclude construction of the Sheppard Subway east of Yonge Street over the long range
- eliminates the need for new tail track facilities at the Finch terminal
- may reduce terminal costs of the Wilson-Sheppard extension.

The principal disadvantages relate to the fact that the Finch Loop provides little or no development benefit for the Scarborough City Centre and that it precludes eventual extension of the Yonge Subway north of Finch.

Although this comparative analysis strongly favours the Finch Loop option, at least with respect to the other options for transit expansion beyond the base case, two qualifications should be raised at this time.

First, as noted in Chapter 3, four alternative networks were developed for evaluation on the basis of consensus reached by representatives of the provincial and municipal transportation agencies participating in the Review Committee. Subsequent analysis was limited to the agreed upon Base Case and the three network expansion options. During the course of this analysis, however, other options also emerged which, with the benefit of hindsight, may appear equally as interesting.

For example, in the case of the Finch Loop, possible variations include extending the loop portion of the rapid transit component further north to say, Steeles Avenue. Obviously, this variation would require increased capital investment because the length of subway construction is increased considerably. Enlarging the loop, however, intuitively, should attract additional cross boundary traffic.[1]

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[1] A subway loop along Sheppard Avenue, connecting the Spadina Subway extension to the Yonge Subway represents another variation that could be considered. In this case, however, none of the operational advantages with respect to increased capacity would be realized. This variation is essentially the first stage of the Sheppard Emphasis alternative.

Similarly, variations are possible in the case of the Radial Network. In part, the lower cost effectiveness of this alternative in relation to the Finch Loop derives from lengthy construction of a subway through relatively low density areas. The length of subway construction could be reduced by terminating the Yonge Subway extension at the Metro boundary and, in the case of the Spadina extension, following the most direct route to the Metro boundary along Dufferin Street.

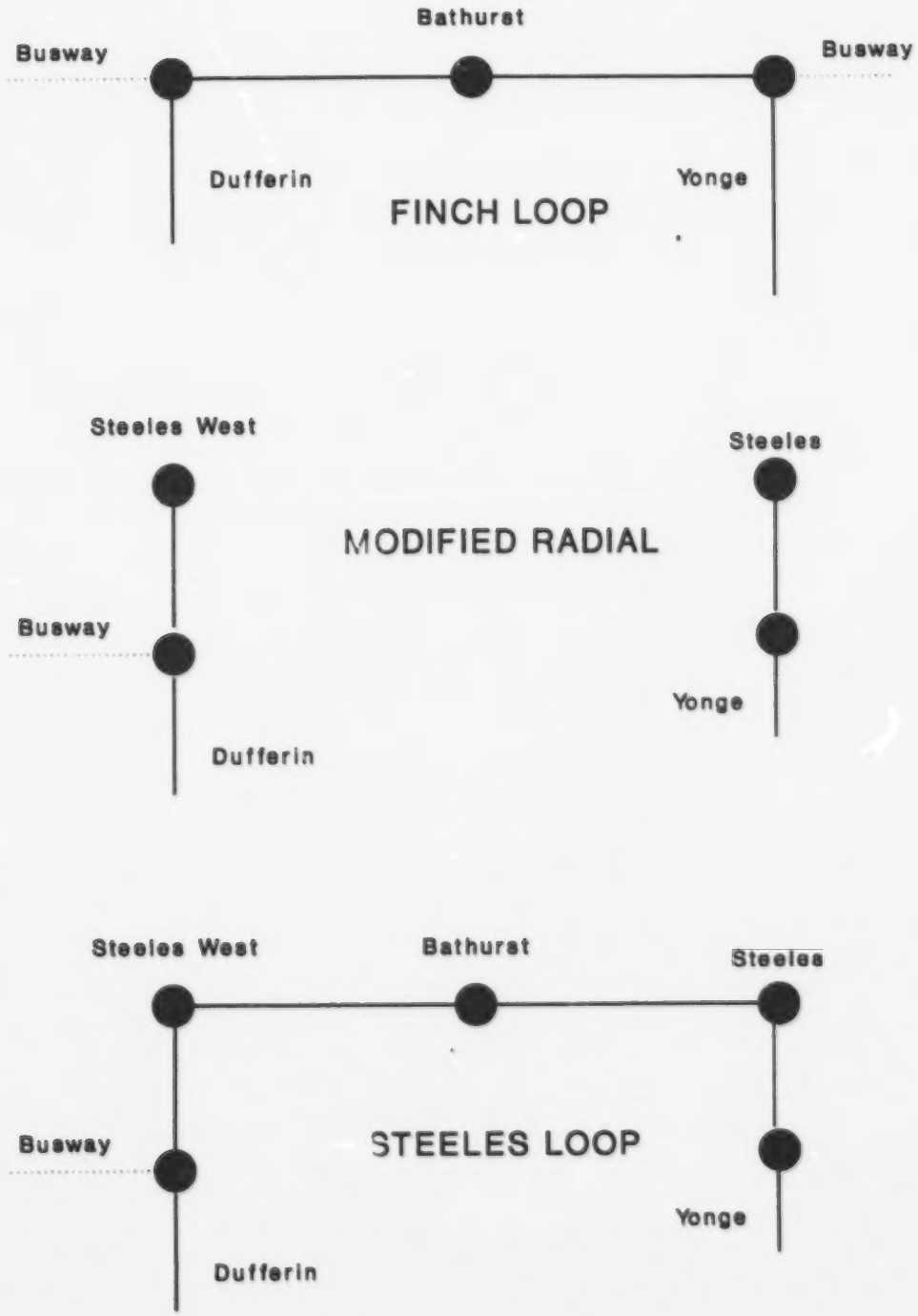
The second major qualification concerns the proposed reserved bus lanes within the Hydro corridor and, in particular, the possibility of serious community opposition to any construction within the portion of the corridor east of Yonge Street, regardless of how unobtrusive such construction might be. (West of Dufferin Street, the nature of abutting land use is such that little, if any, opposition should arise.) Although the nuisance impacts are minimal for the type of facility suggested, previous proposals for other types of transportation facilities involving elevated structures (for example, 1972 provincial proposals for the original Intermediate Capacity Transit System) and/or noisy vehicles (such as dangerous goods trains) have already sensitized the community adjacent to this section of the Hydro corridor.

This possibility of community opposition to the eastern busway component of the Finch Loop option suggests two variations similar to those already discussed above, namely, either an enlarged loop traversing Steeles Avenue, or a modified radial network with subway terminals at Steeles Avenue. These variations are compared, schematically, in Exhibit 4.8.

In both variations, the western section of the proposed Hydro corridor busway is retained whereas the section east of Yonge Street is eliminated and replaced by reserved transit lanes on Steeles and Finch Avenues. Aside from the community based concerns noted above, extension of the north-south elements of the subway network to Steeles Avenue, in both cases, reduces both the need and effectiveness of the busway from the standpoint of cross boundary transit. For many cross boundary buses, reserved bus lanes on Steeles Avenue would offer shorter travel times to the subway system than a connection

Exhibit 4.8

Schematic Comparison of Modified Radial and Steeles Loop Options



at Finch Avenue by way of the Hydro corridor busway. In fact, the same argument might apply to the section of the proposed busway west of Dufferin Street, as well.

An additional feature of these modifications relates to certain cross boundary institutional issues. With subway terminals at Steeles Avenue, cross boundary bus travel would be all but eliminated, thereby adding considerable flexibility to the network of York Region transit services that eventually emerges, both with respect to route structure and choice of technology. For example, in the event some form of higher order transit, such as LRT or RT is considered on Yonge Street by the Region, it could be constructed entirely within York Region, connecting with the TTC subway system at the York-Metro boundary and thereby avoiding possible issues related to the relatively short segment within Metro between the present Finch terminal and Steeles Avenue.

For purposes of illustration, Exhibit 4.9 provides very approximate estimates only of the relative construction and vehicle costs of the Finch Loop and both the Modified Radial and Steeles Loop variations. Cost differences between the Modified Radial and Finch Loop (about $25 million) are modest, if not insignificant, given the accuracy of these planning costs, largely because there is little difference in the total length of subway construction. The Steeles Loop variation is considerably more expensive due to its added length (and the loss of low cost construction advantages of the Hydro corridor) and the larger fleet of subway cars required. Although a separate travel demand impact analysis has not been carried out for these variations, qualitative judgements suggest travel and operational benefits that should be comparable to those for the Finch Loop.

These examples simply illustrate that although the analysis which was limited to the four well defined transit options clearly favours the Finch Loop over the Sheppard Emphasis from the standpoint of relative cost effectiveness, there is obviously some room for further sensitivity analysis of possible refinements that have yet to be considered at the same level of detail.

Exhibit 4.9

Comparative Capital Costs of Finch Loop Variations

Item	Finch Loop	Modified Radial	Steeles Loop
Stations	2	3	4
Length (km)	6.50	6.35	10.70
Open Cut	2.55		
Tunnel and Cut & Cover	3.95	6.35	10.70
Costs ($ Millions)			
Stations	41.5	61.5	81.5
Earthwork			
Open Cut	4.7		
Tunnel	95.0	152.7	257.3
Substation	6.0	5.9	9.9
Ventillation	7.5	7.3	12.3
Overpass	0.5	0.5	0.5
Crossover	1.5	1.5	1.5
Track	13.0	12.7	21.4
Signals	16.3	15.9	26.8
Supervisory Control	4.1	4.0	6.7
Sub Total	190.0	262.0	417.9
EPCM	100.0	137.8	219.9
Total	290.0	399.8	637.8
Busway			
West of Dufferin	42.5	42.5	42.5
East of Yonge	80.6		
Sub total	123.1	42.5	42.5
Total Construction	413.1	442.3	680.3
Subway Cars	61.0	59.6	100.4
Total Investment	474.1	501.9	780.7

5. Conclusions

In summarizing the conclusions of this study, a number of qualifications should be noted at the outset. First, the perspective adopted has been motivated largely by the problems associated with cross boundary or inter-regional travel between Metropolitan Toronto and the Region of York. Certainly, as part of this process, attention has been paid to transportation issues as well as land use issues solely within Metropolitan Toronto. Nevertheless, different conclusions might be reached if the perspective adopted related only to Metropolitan Toronto.

Second, some of the alternatives developed for consideration might not have been included in the absence of prior commitments or approvals at some level of decision making which could not be realistically ignored. Metro approval of the Sheppard Subway and joint Ministry and Metro approval of the Spadina Subway extension to Sheppard Avenue represent two cases in point, the first of which cannot be ignored and the second of which must be taken as a given, even though construction has yet to begin.

Third, the range of alternatives considered is somewhat restricted, partly by time and resource limitations, and partly in response to explicit guidelines established during the course of study. In fact, the evaluation of the previous Section suggests possible variations of the basic alternatives as equally interesting possibilities.

Fourth, the area of study is limited to the area north of Highway 401 in Metropolitan Toronto and the southern portion of the Region of York. Thus, the attractiveness of transit improvements suggested in this study has not been compared against the cost effectiveness and benefits associated with other major transit improvements, either elsewhere in Metropolitan Toronto or within the Greater Toronto Area.

Nevertheless, recognizing that all studies of this nature are eventually limited in scope by some constraints, the conclusions summarized below reflect the key findings related to the transit alternatives discussed in the preceding chapters.

Travel Demand

1. Anticipated growth in population and employment and its distribution throughout the Greater Toronto Area suggests a large increase in travel demand, primarily related to work trips, across the boundary between Metropolitan Toronto and the Region of York, in both directions.

2. The largest component of this cross boundary travel will be between the central section of York Region and the entire Yonge Street corridor within Metropolitan Toronto, including the North York City Centre, other major development nodes at subway stations, and downtown locations.

3. In addition to growth in downtown oriented work trips from other areas of York (primarily from Central York and Markham), significant growth in work trips is also expected between the eastern portion of south York (Markham) and northeast Metro (including the Scarborough City Centre) and to the west, between Vaughan and northwest Metro. A substantial increase in reverse flow, cross boundary work trips is also expected from Metro to York.

4. Existing cross boundary travel already creates considerable congestion on north-south arterials at various locations within the study area, including the boundary at Steeles Avenue. Congestion levels will continue to increase with the growth in cross boundary work trips. Even with planned improvements in road capacity, it will not be possible to accommodate all future peak period travel by automobile with any reasonable level of service. By far, the largest deficiencies in road capacity will occur in the central section of the Steeles Avenue boundary (between Highway 400 and Highway 404). However, the uneven distribution of traffic along the boundary will also result in serious deficiencies elsewhere.

5. The analysis of future demand suggests that much greater reliance on public transit will be necessary, if increases in cross boundary travel are to be accommodated with acceptable levels of service. For the downtown oriented work trips, significant increases in modal split will be necessary, which can best be achieved through expansion of service on all three GO Transit commuter rail routes. Such expansion

should also provide some relief for existing surface transit services, as well as the Yonge Subway, which now handles most of this downtown oriented traffic, particularly from central York.

6. For the balance of the cross boundary travel demand, expansion of the rapid transit system within Metropolitan Toronto, more extensive use of higher order surface transit (such as exclusive transit and high occupancy vehicle lanes), and improvements in the integration of cross boundary and intra-regional services (both in York and Metropolitan Toronto) represent the possible range of opportunities for increased modal split.

7. Realistic responses to cross boundary transit issues must be sensitive to, and adequately reflect, transit needs of Metropolitan Toronto, including those related to land use objectives embodied in the Metro Official Plan. As a result, the four transit options developed for evaluation attempt to accommodate a diverse range of goals related both to cross boundary transit issues and priorities already identified by Metropolitan Toronto.

The Base Case Option

8. Among the four alternatives considered, transit improvements included in the Base Case option (over and above those already approved), all make a significant contribution to cross boundary transportation system deficiencies. These improvements include expansion of GO rail service on the Bradford, Richmond Hill, and Stouffville routes (including new stations in Scarborough) as well as the construction of reserved transit lanes on the north-south arterials identified in this study. In addition, the construction of reserved transit lanes along Sheppard Avenue, including grade separated bus access to the Sheppard station, would contribute to improved transit service within the Metro portion of the study area, and would reduce congestion in the Sheppard corridor.

9. Base Case improvements are expected to attract a substantial proportion of the total cross boundary transit potential (17,000 out of the 21,000 potential peak hour trips forecast for 2011) leaving a residual of some 4,000 trips that could be attracted to transit as a result of additional transit improvements. From the standpoint of cross boundary travel alone, therefore, potential benefits of further rapid transit expansion beyond the Base Case are relatively modest.

10. The Base Case option, however, provides few operational advantages with respect to congestion and level of service on the existing subway system or on east-west arterials within Metro.

11. Although proposed expansion of the Stouffville commuter rail service (including new stations) does support development of the Scarborough City Centre, the Base Case provides limited support for development of the North York City Centre.

12. The Base Case also raises questions as to the rationale for the already approved Spadina Subway extension to Sheppard Avenue inasmuch as travel impacts for this large capital investment will be negligible without some additional expansion of the rapid transit network.

The Finch Loop Option

13. Of the three alternatives for expansion of the Base Case, the Finch Loop option is the most cost effective from the standpoint of the impacts considered. At an estimated capital investment of $481 million above the Base Case, for both the subway and busway components of this alternative, this option represents a saving of $1,341 million with respect to the Sheppard Emphasis and $409 million with respect to the Radial Network options (considering only capital costs).

14. The Finch Loop option supports further development of the North York City Centre, increases cross boundary transit use by about 10% compared to the Base Case, allows for a 10% increase in the capacity of the Yonge Subway, has significant operational benefits with respect to redistributing traffic to the Spadina Subway, and improves opportunities for integration of cross boundary transit services with the TTC network. The crosstown busway component associated with the Finch Loop option should also reduce congestion on east-west arterials and improve the level of service for transit users within Metro.

15. Recognizing the continuum of development represented by three distinct subway stations now serving the North York City Centre, the Finch Loop option should be as supportive of development of this centre as the Sheppard Emphasis option, but slightly less supportive than the Radial Network option. It is also supportive of new development potential at Yonge and Highway 401 (McLean Hunter site), Finch and Keele, and York University.

16. The Finch Loop option provides little or no support for the Scarborough City Centre or other development potential within the Sheppard Avenue corridor, over and above the Base Case. However, given the large capital cost savings involved in this option, other transit alternatives which support the Scarborough Centre, such as extension of the existing RT, can be considered.

Possible Loop Variations

17. Although the conclusions of this study favour the Finch Loop among the four options considered, other variations in transit system development are possible that have emerged as a result of the analysis, which show potential for equivalent or even better cost effectiveness and which may, in fact, require more detailed consideration in the event of serious community opposition to some segments of the Hydro corridor busway.

18. Among these variations, a *Modified* Radial Network, involving extension of the Yonge Subway to Steeles Avenue and extension of the Spadina Subway along Dufferin Street to the Metro boundary, in combination with reserved bus lanes on Steeles and Finch Avenues, should produce impacts comparable to those of the Finch Loop option at a similar total capital cost. Another, more costly, variation involves completing the Yonge-Spadina loop along Steeles Avenue by connecting the Metro boundary terminals of the *Modified* Radial Network (including an additional station at Bathurst Street).

19. Under either of these variations, railheads to the Yonge-University-Spadina subway system at the Metro boundary would introduce greater flexibility with respect to route structure and the choice of transit technology within York Region. In addition, on the basis of projected increases in travel to the North York Centre from the north, both variations provide slightly better support for development of the North York City Centre.

Recommended Actions

20. Given the time period required to construct the approved portion of the Spadina Subway, there is certainly time within the near future to give these variations further consideration before committing to the entire subway expansion component of the Finch Loop.

21. As an interim step, therefore, in making long awaited decisions on future expansion of the TTC subway system within north Metro, a further commitment to extending the Spadina Subway at least as far north as the Finch Hydro corridor as the first stage of completing the Finch Loop or some modification thereof, would be an appropriate action at this time.

22. The appropriate scheduling of these improvements should be established within the context of a comprehensive review of other transportation priorities elsewhere within the GTA that have not been considered in this study.

Appendix A

Exhibit No.	Description
A.1	Finch Loop Subway Cost Estimates
A.2	Spadina Subway Extension to York University Cost Estimates
A.3	Yonge Subway Extension to Highway 7 Cost Estimates
A.4	Finch Hydro Corridor Busway Cost Estimates

PROJECT: North Boundary Study
DATE: 89.06.15
USER: M Schatz, J Ramsay

Hatch Project # 86022 Exhibit A.1

NETWORK 3 - SUBWAY CONSTRUCTION COSTS
ALLEN ROAD, YONGE STREET LOOP

***** ALLOWANCES *****
22% Engineering
25% Contingency
52.5% Total

ITEM	UNIT COST	Units	Number UNITS	Units	COST ($1000) WITHOUT ALLOW.	COST ($1000) WITH ALLOW.
Cut & Cover - On Street	22,500	$/dtm	100	dtm	2,250	3,431
Cut & Cover - Off Street	19,500	$/dtm	750	dtm	14,625	22,303
Tunnel: Bore 1	21,500	$/dtm	2250	dtm	48,375	73,772
Bore 2	35,000	$/dtm	850	dtm	29,750	45,369
At Grade Cut (3m)	1,850	$/dtm	2550	dtm	4,718	7,194
SUB-TOTAL 1			6500	dtm	99,718	152,069
Finch & Dufferin Station	25,000,000	each	1	No.	25,000	38,125
Bathurst & Finch Station	16,500,000	each	1	No.	16,500	25,163
SUB-TOTAL 2			2	No.	41,500	63,288
Substation Stucture & Equipment, every 2 km	2,000,000	each	3	No.	6,000	9,150
Emergency Fan/Vent Shaft Structure, every 0.8 km	750,000	each	3	No.	7,500	11,438
Road Overpass	500,000	each	1	No.	500	763
Cross Over	1,500,000	each	1	No.	1,500	2,288
Trackwork, Power Rail, & Traction	2,000	$/dtm	6500	dtm	13,000	19,825
Signals	2,500	$/dtm	6500	dtm	16,250	24,781
Supervisory Control	625	$/dtm	6500	dtm	4,063	6,195
SUB-TOTAL 3					48,813	74,439
TOTAL					190,030	289,796

Notes: dtm = double track metre
Dollars are for mid 1989 calculated using a 1.12 factor from 1987 dollars.

PROJECT: North Boundary Study
DATE: 89.06.15
USER: M Schatz, J Ramsay

Hatch Project # 86022 Exhibit A.2

NETWORK 4 - SUBWAY CONSTRUCTION COSTS
SPADINA EXTENSION TO YORK UNIVERSITY

***** ALLOWANCES *****
22% Engineering
25% Contingency
52.5% Total

ITEM	UNIT COST	Units	Number UNITS	Units	COST ($1000) WITHOUT ALLOW.	COST ($1000) WITH ALLOW.
Cut & Cover - Off Street	20,500	$/dtm	2000	dtm	41,000	62,525
Cut & Cover - On Street	22,500	$/dtm	300	dtm	6,750	10,294
Open Channel	10,500	$/dtm	600	dtm	6,300	9,608
Tunnel	27,000	$/dtm	1100	dtm	29,700	45,293
At Grade Cut (3m)	1,850	$/dtm	2150	dtm	3,978	6,066
SUB-TOTAL 1			6150	dtm	87,728	133,784
Finch & Keele Station	16,500,000	each	1	No.	16,500	25,163
Steeles & Keele Station	25,000,000	each	1	No.	25,000	38,125
SUB-TOTAL 2			2	No.	41,500	63,288
Substation Stucture & Equipment, every 2 km	2,000,000	each	3	No.	6,000	9,150
Emergency Fan/Vent Shaft Structure, every 0.8 km	750,000	each	3	No.	2,250	3,431
Road Overpass	500,000	each	1	No.	500	763
Cross Over	1,500,000	each	1	No.	1,500	2,288
Trackwork, Power Rail, & Traction	2,000	$/dtm	6150	dtm	12,300	18,758
Signals	2,500	$/dtm	6150	dtm	15,375	23,447
Supervisory Control	625	$/dtm	6150	dtm	3,844	5,862
SUB-TOTAL 3					41,769	63,697
TOTAL					170,996	260,769

Notes: dtm = double track metre
Dollars are for mid 1989 calculated using a 1.12 factor from 1987 dollars.

PROJECT: North Boundary Study
DATE: 89.06.16
USER: M Schatz, J Ramsay

Hatch Project # 86022 Exhibit A.3

NETWORK 4 - SUBWAY CONSTRUCTION COSTS
NORTH YONGE TO HWY. 7

***** ALLOWANCES *****
22% Engineering
25% Contingency
52.5% Total

ITEM	UNIT COST	Units	Number UNITS	Units	COST ($1000) WITHOUT ALLOW.	COST ($1000) WITH ALLOW.
Tunnel: Bore 1	21,500	$/dtm	2000	dtm	43,000	65,575
Bore 2	16,000	$/dtm	4100	dtm	65,600	100,040
SUB-TOTAL 1			6,100	dtm	108,600	165,615
Yonge & Steeles Station	16,500,000	each	1	No.	16,500	25,163
Yonge & 14th Station	16,500,000	each	1	No.	16,500	25,163
Yonge & Hwy. 7 Station	25,000,000	each	1	No.	25,000	38,125
SUB-TOTAL 2			2	No.	58,000	88,450
Substation Stucture & Equipment, every 2 km	2,000,000	each	3	No.	6,000	9,150
Emergency Fan/Vent Shaft Structure, every 0.8 km	750,000	each	6	No.	4,500	6,863
River Crossing	700,000	each	1	No.	700	1,068
Cross Over	1,500,000	each	1	No.	1,500	2,288
Trackwork, Power Rail, & Traction	2,000	$/dtm	6100	dtm	12,200	18,605
Signals	2,500	$/dtm	6100	dtm	15,250	23,256
Supervisory Control	625	$/dtm	6100	dtm	3,813	5,814
SUB-TOTAL 3					43,963	67,043
TOTAL					210,563	321,108

Notes: dtm = double track metre
Dollars are for mid 1989 calculated using a 1.12 factor from 1987 dollars.

Finch Hydro Corridor Busway

Section	*Length*	*Cost*	*in $ Millions Contingencies*	*Total*
W. of Hwy. 400 to Dufferin	6.1	34.0	17.0	51.0
Yonge to Victoria Park	6.9	46.4	23.2	69.6
Victoria Park to McCowan	5.3	18.1	9.0	27.1
Sub Totals	18.3	98.5	49.2	147.7
Dufferin to Yonge	4.5	22.9	11.4	34.3
Totals	22.8	121.4	60.6	182.0